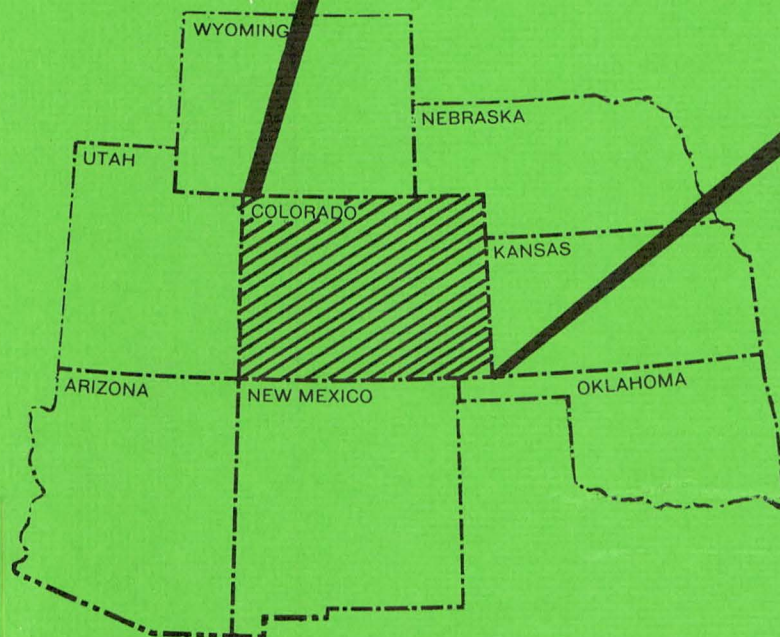
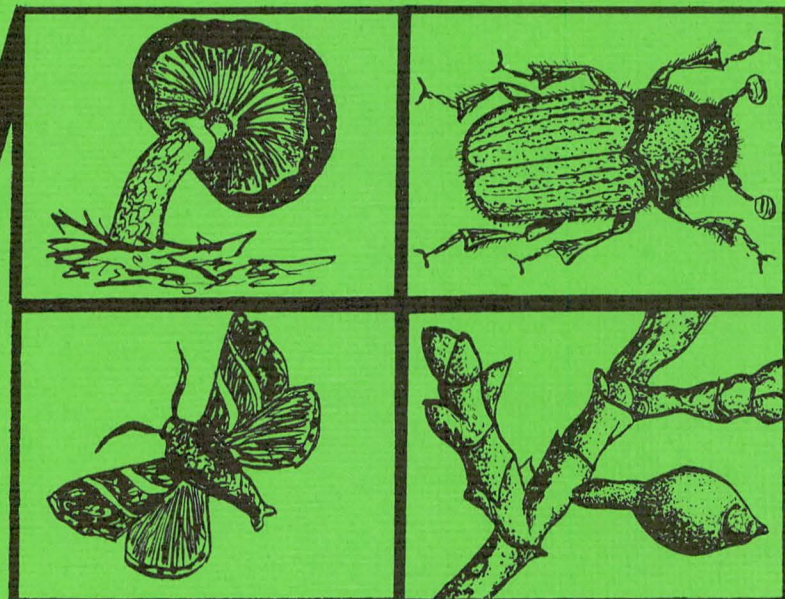


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FOREST INSECT AND DISEASE CONDITIONS

COLORADO 1978-79



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INSECT AND DISEASE
CONDITIONS

1978 - 1979

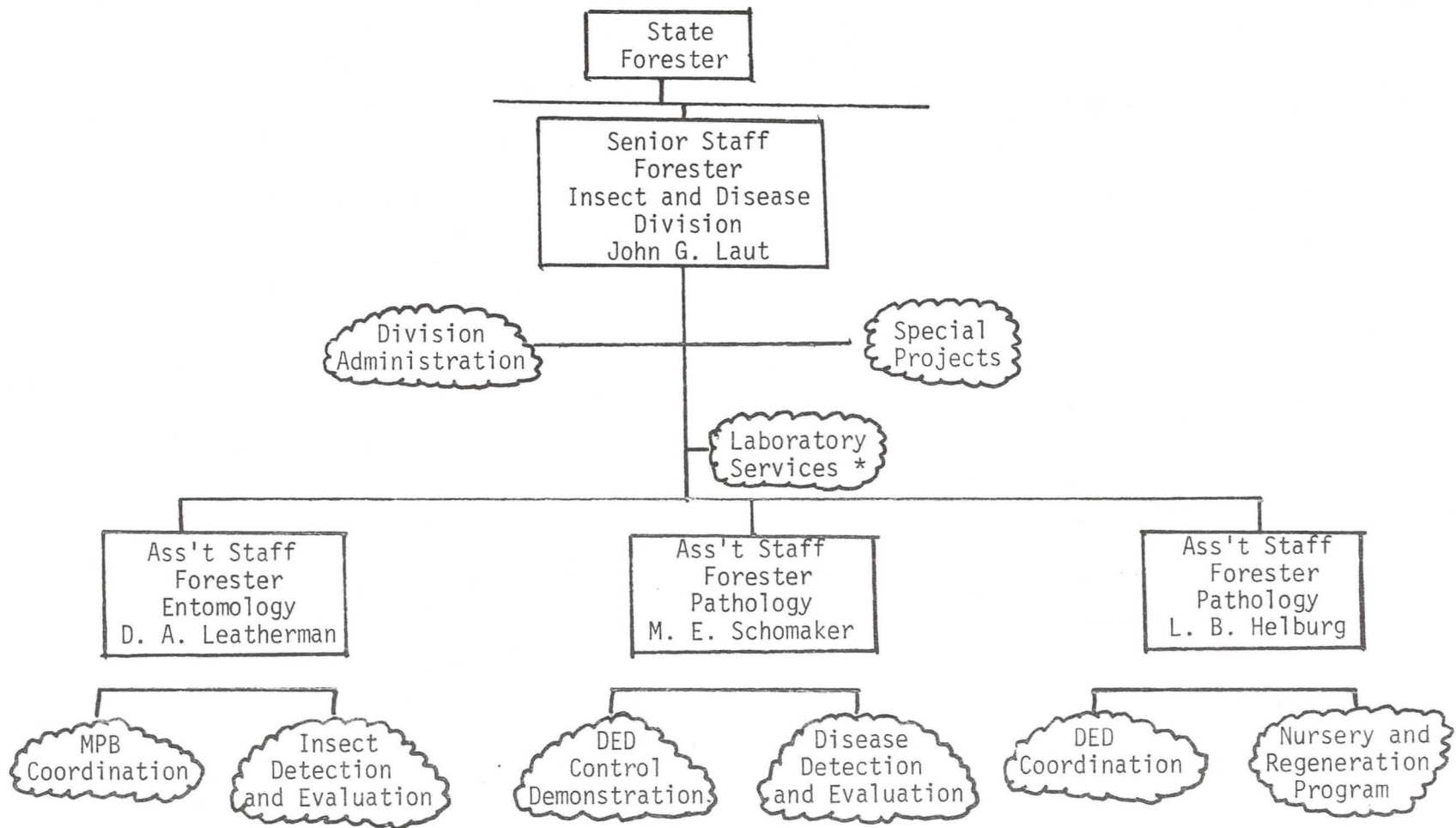
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Insect and Disease Division
Colorado State Forest Service
Colorado State University
Room 214, Forestry Building
Fort Collins, CO 80523

-- May, 1980 --

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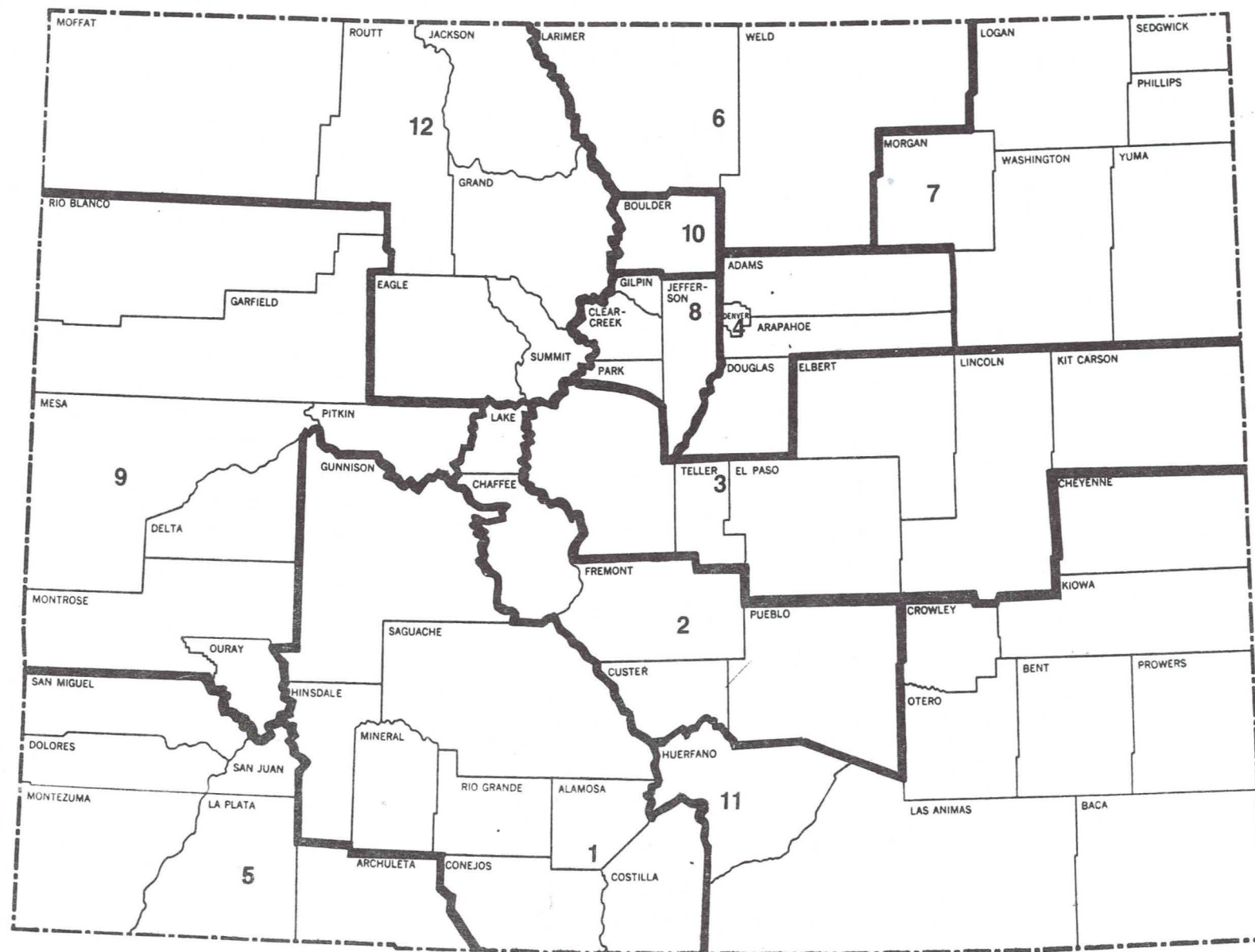
Positions

Responsibilities

* Laboratory services available:

- ... Identification of disease organisms and insects.
- ... Control advice and recommendations.
- ... General or specific information on tree insects and diseases.
- ... Service of special requests.
- ... For field diagnosis of tree problems, contact the local District Office of Colorado State Forest Service.

COLORADO



COLORADO STATE FOREST SERVICE DISTRICTS (DISTRICT NAME....DISTRICT OFFICE SITE)

1 Alamosa.... Alamosa
2 Canon City.... Canon City
3 Woodland Park..... Woodland Park
4 Denver.... Aurora

5 Durango.... Durango
6 Fort Collins.... Fort Collins
7 Fort Morgan.... Fort Morgan
8 Golden.... Golden

9 Grand Junction.... Grand Junction
10 Boulder..... Left Hand Canyon
11 Lower Arkansas (LARK).... LaVeta
12 Steamboat Springs.... Steamboat Springs

COLORADO STATE FOREST SERVICE

ALAMOSA DISTRICT

Colorado State Forest Service	589-2271
P. O. Box 1137	852-3801
Alamosa, CO 81101	

BOULDER DISTRICT

Colorado State Forest Service	442-0428
Lefthand Canyon	
Jamestown Star Route	
Boulder, CO 80302	

CANON CITY DISTRICT

Colorado State Forest Service	275-6853
P. O. Box 590	
Canon City, CO 81212	

DENVER DISTRICT

Colorado State Forest Service	341-7941
13101 E. Mississippi Avenue, Suite 230	
Aurora, CO 80012	

DURANGO DISTRICT

Colorado State Forest Service	247-5250
P. O. Box 333 FLC	
Durango, CO 81301	

FORT COLLINS DISTRICT

Colorado State Forest Service	482-9512
Building #360, Foothills Campus	491-8660
Colorado State University	
Fort Collins, CO 80523	

FORT MORGAN DISTRICT

Colorado State Forest Service	867-5610
1117 E. Burlington	
Fort Morgan, CO 80701	

GOLDEN DISTRICT

Colorado State Forest Service	279-9757
1504 Quaker Street	
Golden, CO 80401	

COLORADO STATE FOREST SERVICE

GRAND JUNCTION DISTRICT

Colorado State Forest Service
Petroleum Building
1129 Colorado Avenue, Room 209
Grand Junction, CO 81501

242-7518

LOWER ARKANSAS (LARK) DISTRICT

Colorado State Forest Service
P. O. Box 81
La Veta, CO 81055

742-3588

SALIDA DISTRICT

(To be opened in 1980)

STEAMBOAT SPRINGS DISTRICT

Colorado State Forest Service
P. O. Box 520
Steamboat Springs, CO 80477

879-0475

WOODLAND PARK DISTRICT

Colorado State Forest Service
P. O. Box Y
Woodland Park, CO 80863

687-2921
687-2951

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ACKNOWLEDGMENTS

We must thank all those individuals and agencies who contributed information and assistance to this report.

Amongst those special mention goes to field staffs of Colorado State Forest Service Districts; their eyes and ears are the basis of our surveillance and control programs. Research pathologists and entomologists of the Rocky Mountain Forest and Range Experiment Station, U. S. Forest Service; FIDM Staff of the U. S. Forest Service (especially Rocky Mountain Region); John Peacock and Roy Cuthbert of the Northeastern Forest Experiment Station, Delaware, Ohio have all made special contributions to our programs.

City foresters and arborists, commercial arborists, Cooperative Extension Service personnel and private citizens have all contributed to this report.

INTRODUCTION

The first report of this series was published in March, 1978 and summarized information on tree insects and diseases through 1977. This report summarizes significant changes in status of those situations and in our knowledge since that time, as well as our 1979 records. Continuing emphasis is on state and private lands (including urban areas) in accordance with our charged responsibilities.

The purposes of this report include:

- ... To serve as a handy reference on the what, where and extent of insect and disease conditions in Colorado during the past year.
- ... To continue a reasonably complete inventory of Colorado's significant and potentially significant pests by host.
- ... To continue accumulation of information of historical and, hopefully, immediate value to present and future professionals having forest protection responsibilities.
- ... To alert (for both practical and educational reasons) foresters and landowners to pest problems in areas of the state other than their own.
- ... To relay and introduce new or otherwise interesting pest problems and trends.
- ... To inform the public and interested governmental agencies of recent activities and available services within the I&D Function of Colorado State Forest Service.
- ... To present local pest conditions in light of their state-wide impact or importance (this should allow for between-locale and between-year comparisons).

Readers interested in pest conditions for a given geographic area are referred to Appendix I where all listings for each county are given. Also see Appendix II for a listing of pests by tree host.

For more information, the reader should contact district offices of the Colorado State Forest Service or the State Office in Fort Collins.

INSECT AND DISEASE CONDITIONS

This section reports details of significant insect and disease situations by groups of causal organisms. Well known locations are given without further identification. For other locations, the appropriate county is given in parentheses.

Within each section the most serious or extensive situations are discussed first. Other situations follow in order of decreasing damage.

I: FOREST DISEASES

A. Needle Casts --

Lirula abietis was reported on *Abies concolor* in Costilla, Huerfano and Las Animas Counties. In each case damage was minimal on only a few trees. One collection of *Elytroderma deformans* on *Pinus edulis* was made from Alamosa County.

Lophodermella concolor was reported on *Pinus contorta* in Larimer County.

B. Leaf Spots and Blights --

Marssonina sp. caused slight, but visible, damage to aspen in Boulder and Routt Counties in 1978 and Anthracnose (*Gnomonia platani*) was reported on individual sycamores in Adams and Morgan Counties.

However, in 1979, perhaps due to a greater than average rainfall in many areas of Colorado during the summer, there was an increase in the number of foliage diseases reported. *Ciborinia whetzelii* was reported in Archuleta, Boulder, Eagle and Hinsdale Counties. *Marssonina populi* was detected in Archuleta, Larimer and Routt Counties. Both of these aspen leaf spots covered large areas within the counties reported.

Other foliage diseases reported were not as widespread and were found on individual trees:

Cherry -- *Xanthomonas pruni* in Weld County.

Oak -- *Taphrina caerulescens* in La Plata and Dolores Counties.

Apple -- Powdery Mildew in Mesa County.

Hackberry -- Powdery Mildew in Yuma County.

Cottonwood -- *Venturia* leaf blight in Rio Blanco and Weld Counties.

Aspen -- *Pollacia radiosa* in Hinsdale and Huerfano Counties.

C. Rusts --

SPRUCE WITCHES' BROOM (*Chrysomyxa arctostaphyli*) -- Areas of heavy infections were reported at Tarryall Reservoir (Park County), Douglas Pass (Garfield County), Apishapa Pass and Cucharas Pass (Huerfano County). Brooms were very severe with heavy mortality of Englemann spruce noticed on both Apishapa and Cucharas passes.

Additional reports came from Custer, Grand, Jackson, La Plata, Larimer and Routt Counties. This disease appears to be widespread

throughout Grand, Jackson, Larimer and Routt Counties, but is causing very little mortality in these areas.

FIR WITCHES' BROOM (*Melampsorella caryophyllacearum*) -- Reported in Archuleta, Custer, Grand, Jackson, La Plata and Larimer Counties. This disease is widespread in true firs, but is not causing any serious problems.

COMANDRA RUST (*Cronartium comandrae*) -- This disease was reported in 1978 on lodgepole pine in Jackson and Larimer Counties. In Larimer County, the disease appeared to be rather heavy in the Diamond Peak Ranch area with spike tops and some mortality present.

From those reports, it was decided that a survey of this rust would be conducted in 1979. Comandra blister rust was found throughout the lodgepole pine stands in Larimer, Jackson, Routt and Grand Counties. From the windshield survey, it appeared that the heaviest incidence occurs north of the Poudre River in Larimer County and in the State Forest in Jackson County. Many spike tops were noted but there was very little tree mortality in any of these counties.

OTHER RUSTS REPORTED --

These rusts were reported for individual trees or small pockets of minor significance:

Western gall rust (*Endocronartium harknessii*) in Boulder, Grand, Jackson and Larimer Counties.

Juniper broom rust (*Gymnosporangium ~~nidus-avis~~*) in Alamosa, Costilla, Saguache and Larimer Counties.

Juniper gall rust (*Gymnosporangium* sp.) (1978) in Las Animas, Larimer, Moffat, Rio Grande, Alamosa, Boulder, Garfield, Otero, Saguache and Archuleta Counties.

D. Dwarf Mistletoes --

The distribution of dwarf mistletoes in Colorado was reported in the 1977 edition of this report. No new locations (by county) were reported in 1978 or 1979, even though special surveys were made in the extreme southeast and northwest corners of the State.

E. Cankers --

THYRONECTRIA (*Thyronectria austro-americana*) --

Thyronectria austro-americana was the most frequently reported canker disease of urban trees. New locations for this disease were Bent, Huerfano, La Plata, Yuma, Mesa and Arapahoe Counties.

These additions brought the total to 17 counties in Colorado that have reported this disease. Aurora (Adams County) appeared to have the heaviest infection level with a total of 39 trees cankered. An evaluation was done in three subdivisions in metropolitan Denver, two in Aurora and one in Littleton, to determine frequency of the disease and factors contributing to that level.

Data from the evaluation are listed in the following table.

Area	Total Trees	Healthy	Unhealthy #	%	Diseased #	%	Approx. Area Sq. Mi.	Tree Density Trees/ Sq. Mi.
Littleton plot	313	309	0	0	4	1.3	1.38	227
Morrison Heights	416	406	1	.2	9	2.2	.40	1040
Chambers Heights	365	339	12	3.3	14	3.8	.30	1217

The Littleton plot had better quality trees with better maintenance practices than the Morrison Heights and Chambers Heights plots.

While no specific surveys were done for *Thyronectria* in 1979, it was reported and confirmed in Adams, Arapahoe, Larimer, Las Animas, Mesa, Otero and Phillips Counties. Otero and Phillips are new locations bringing the total to 19 counties now reporting the disease. This disease is still a major factor in honeylocust mortality, especially in the City of Aurora (Adams County).

GUMMOSIS OF RUSSIAN OLIVE (*Phytophthora cactorum*) --

This disease was reported from Canon City (Fremont County) and Fort Collins (Larimer County). It has also been reported from Alamosa, Jefferson and Rio Blanco Counties.

Three fungi have previously been implicated in this disease. *Phytophthora cactorum* (identified by Dr. Wayne Nishijima) was cultured from a diseased tree in Fort Collins. We now believe it to be the principle cause of gummosis.

ASPEN CANKERS (*Cytospora chrysosperma*, *Phibolia pruinosa*, *Ceratocystis fimbriata*, *Cryptosphaeria populina*, and *Hypoxyton mammatum*) --

Cankers caused by these fungi (except *Hypoxyton*) were noted in every aspen stand visited during general disease surveys conducted in Costilla, Garfield, Gunnison, Larimer, Las Animas, Moffat, Archuleta and La Plata Counties. *Hypoxyton mammatum* was first reported in 1979 from Larimer and Pueblo Counties.

CYTOSPORA CANKERS (hosts other than aspen) --

Cytospora chrysosperma was reported throughout the range of *Populus* and *Salix* species in Colorado. Incidence was very high in cottonwoods of the eastern plains. Other species reported were:

Cytospora ailanthi on *Ailanthus altissima* in Mesa County.
Cytospora annularis on *Fraxinus* sp. in Morgan County.
Cytospora gleditschiae is increasing on honeylocust in Adams, Arapahoe, Denver and Huerfano Counties.
Cytospora kunzei on Englemann spruce in El Paso County.
Cytospora persicae on *Prunus persica* in Weld County.
Cytospora sp. on *Prunus* sp. in Arapahoe County and on *Ulmus pumila* in Prowers and Logan Counties.
Cytospora sp. on *Sorbus* sp. in Morgan County.

TUBERCULARIA CANKERS OF SIBERIAN ELMS (*Tubercularia* sp.) --

A detection survey for Botryodiplodia canker of Siberian elms in eastern Colorado was conducted. *Botryodiplodia* was not detected but a canker caused by a *Tubercularia* sp. associated with minor dieback was found in Elbert, Kit Carson, Lincoln, Logan, Phillips, Pueblo and Weld Counties.

OTHER MISCELLANEOUS CANKERS --

Camarosporium celtidis on *Celtis occidentalis* in Larimer County.
Melanconium betulinum on *Betula* sp. in Larimer County.
Nectria cinnabarina on *Betula* sp. in El Paso County.
Nectria galligena on *Betula occidentalis* in Huerfano County.

F. Root Diseases --

BLACK STAIN ROOT DISEASE (*Verticicladiella wagenerii*) --

Many new incidences were reported, predominantly on disturbed lands in La Plata and Montezuma Counties. We also confirmed a second case of this disease on ponderosa pine east of Durango in La Plata County.

This continues to be a serious problem. It appears to be present in most Pinyon-Juniper stands on the Durango District, with heaviest concentrations east of Durango, in stands between Mancos and Dolores, and a small amount in the Allison area. This seems to be the main cause of pinon mortality. No treatment measures have been conducted.

SHOESTRING ROOT ROT (*Armillariella mellea*) --

Confirmed on subalpine fir, ponderosa pine and lodgepole pine. Infected trees are scattered singly or in pockets around the state. One such pocket discovered in Buckhorn Canyon in Larimer County contained approximately 200 lodgepole pine saplings being killed by this fungus. Other counties with notable infections were Routt County on subalpine fir, El Paso County on ponderosa pine, and Chaffee County, also on ponderosa pine.

While conducting surveys for Comandra rust and *Fomes annosus*, in 1979, *A. mellea* was found on many coniferous hosts in Archuleta, Conejos, Custer, Grand, Hinsdale, Huerfano, Jackson, Larimer and Pueblo Counties. In Pueblo County near Lake San Isabel, there were very extensive pockets of this disease causing heavy seedling and sapling mortality.

FOMES ROOT AND BUTT ROT (*Fomes annosus*) --

Fomes annosus was discovered by the U. S. Forest Service (USFS)-Region 2 FIDM in 1978 on white fir for the first time in Colorado. Incidences were reported in Archuleta, Conejos, Custer, Hinsdale, La Plata, Pueblo, Rio Grande and Saguache Counties. The disease was reported as causing little damage. A cooperative survey was conducted by the USFS and Colorado State Forest Service (CSFS) in 1979. *F. annosus* was found on an additional host (subalpine fir) in an additional county (Huerfano). Results of this survey indicate that in Colorado: (1) *F. annosus* appears to be host specific (found only on true firs); (2) *F. annosus* appears to weaken the trees. *Armillariella mellea* or *Scolytus ventralis* subsequently kill the trees; and (3) logging appears to aggravate the problem.

Rhizina undulata --

Numerous fruiting bodies of this fungus were found in the area burned during the 1977 Stonewall Fire (Las Animas County). Regeneration in this area should be monitored for mortality caused by this fungus.

G. Bacterial Diseases --

FIRE BLIGHT (*Erwinia amylovora*) --

Fire blight was common along the Front Range in 1978, but did not appear to be as heavy as in previous years. Reported hosts were ornamental crab apple, apple, plum, Hawthorne, and one case on cherry. In 1979 it was reported from both eastern and western slopes but was heaviest along the northern Front Range (especially in Loveland, Berthoud and Fort Collins in Larimer County). This increase was attributed to excessively moist spring conditions.

BACTERIAL WETWOOD (slime flux) --

This disease became quite significant in 1978, mostly on cottonwood. It is theorized that the wetwood stress, coupled with additional drought stress, caused many trees to decline. In the plains areas where water tables were lower than normal, a tremendous stress was placed on river bank and windbreak trees, and those with bacterial wetwood could no longer compete for the available water.

This disease was reported throughout the range of *Populus* and *Salix* species in Colorado. In 1979 it was apparently increasing with widespread damage in Adams, Arapahoe, Denver and Larimer Counties.

Slime flux of elms was also reported throughout the host range, but was noted as extremely heavy in Siberian elms in the Grand Valley of Mesa County.

BACTERIAL GALLS --

Bacterial gall of Douglas-fir was again at very low levels along the Front Range. Miscellaneous bacterial galls were also reported on aspen and cottonwood.

H. Rots and Miscellaneous Diseases --

Many decays were reported on various hosts this year, but the majority of these did not appear to be significantly damaging on a large scale.

The following table lists the various rots reported in 1978.

<u>Rot</u>	<u>Host</u>
<i>Pleurotus ostreatus</i>	cottonwood, aspen
<i>Phellinus tremulae</i>	aspen
<i>Ganoderma applanatum</i>	aspen, narrow-leaf cottonwood
<i>Echinodontium tinctorium</i>	white fir
<i>Polyporus hispidus</i>	American elm
<i>Polyporus volvatus</i>	ponderosa pine, Douglas-fir
<i>Fomes juniperinus</i>	Rocky mountain juniper
<i>Fomes nigrolimitatus</i>	Engelmann Spruce, house logs
<i>Fomes pinicola</i>	ponderosa pine, Engelmann spruce, Douglas-fir
<i>Fomes</i> sp.	black locust, white poplar

Polyporus volvatus was found on ponderosa pine in a year old burn near Stonewall (Las Animas County). These trees were being salvaged for mining timber. It was noted that the presence of this rot should be considered in any further logging of the area.

Black Knot of Cherry (*Plowrightia morbosum*) and Plum Pocket (*Taphrina pruni*) were reported on *Prunus* species in eastern Colorado in 1978, but were not significant.

Cottonwood mortality along the Platte River east of Brush to the Nebraska border was reported. Changes in water table levels are presumed the primary cause.

I. Dutch Elm Disease (DED) --

Forty-nine municipalities conducted effective DED control programs in 1978. This number increased to 55 in 1979. Another 49 areas are now working to control this disease but do not yet meet CSFS standards as effective control programs, i.e., removing all confirmed cases before new broods of lesser European elm bark beetle can be produced.

There were 1474 confirmed cases of DED discovered in Colorado in 1979. Of these, 68% (1001) were removed and/or properly treated. Last year (1978) 1566 cases were confirmed DED, of which 1429 (91%) were removed. Efficient removal activity of 1978 resulted in an overall reduction in losses in 1979; however, the relatively poor removal activity in 1979 should result in a slight increase in incidence in 1980.

Diseased elms were discovered in 11 new locations in 1978; however, no new locations were discovered in 1979. Twenty-six counties are now known to contain DED.

The diagnostic laboratory processed 2158 elm samples in 1979; 2164 samples in 1978.

The following Table 1 and graphs (Figs. 1-3) display collected data tabulated by county.

SPECIAL STUDIES

1. Federal DED Control Demonstration Project

In 1977 the federal government funded a DED Control Demonstration Project, under which CSFS initiated intensive, integrated control programs in four Colorado communities to illustrate that this disease can be controlled using known techniques. These communities (Canon City, Eaton, La Junta and Yuma) were selected for their size (small to medium), variable DED control programs, and location. They are exemplary of the Colorado Front Range -- eastern plains towns in which elms are a major component of total tree cover. In 1979 a fifth city, Grand Junction, was added to include a west slope municipality. Since its inception the project has resulted in a significant reduction in DED losses in Eaton, La Junta and Yuma. Canon City has experienced an increase in losses, attributed to an in-flight of contaminated beetles from surrounding areas where sanitation was not strictly practiced. Since Grand Junction is in its first year of the project, the reduction of losses experienced in this area are probably the result of previous community action. Table 2 displays data collected from these five cities. Additional information can be obtained from the comprehensive annual report for this project, available on request.

2. Chemical Prophylactic Treatments

One hundred ten elms on the Colorado State University Campus were injected with MBC-P (Correx^(R)) in 1978. Bioassays revealed varied distribution of the fungicide within the trees, with only 10 (9%) of the samples rated as "good" distribution, 17 (15.5%) were rated as "fair" distribution and 83 (75.5%) rated as "poor." The "good" designation indicates that virtually 100% of the crown contained sufficient concentration of MBC-P to inhibit C.u. in vitro. "Fair" designation was applied to trees with only 75% of the crown protected, and "poor" designation denoted 50% or less of the crown protected.

Table 1. DED HISTORY

Counties* by CSFS District	# Critical Areas	Control Eff.		Program Active		Elm Population In Critical Areas 1979	Confirmed DED Cases		DED Cases Removed or Properly Treated		Percent Removed/ Cases		Other Removals	
		'78	'79	'78	'79		'78	'79	'78	'79	'78	'79	'78	'79
Boulder Co./ District	7	2	3	4	3	30,761	100	139	93	NR	93%	-	53	NR
Chaffee	1	-	1	-	-	10,197	0	0	0	-	-	-	5	5
Fremont	4	3	3	-	-	38,045	194	359	192	329	99%	92%	133	347
Pueblo	6	3	1	1	5	190,320	276	173	269	132	97%	76%	162	96
CC Dist. Total	11	6	5	1	5	238,562	470	532	461	461	98%	87%	300	448
Adams	9	5	3	-	-	39,389	19	13	19	13	100%	100%	33	5
Arapahoe	4	1	0	1	4	27,706	23	NR	21	NR	91%	-	8	NR
Denver	1	1	1	-	-	157,476	191	49	187	49	98%	100%(est)	600	NR
Douglas	3	-	0	-	2	691	18	NR	0	NR	0	-	-	NR
Denver Dist. Total	17	7	4	1	6	225,262	251	62	227	62	90%	100%	641	5
La Plata	1	-	1	1	-	2,665	0	0	-	-	-	-	NR	NR
Montezuma	1	-	1	1	-	8,209	0	0	-	-	-	-	NR	NR
Durango Dist. Total	2	-	2	2	-	11,074	0	0	-	-	-	-	-	-
Larimer	4	1	3	3	1	34,413	114	191	106	171	93%	89%	49	13
Weld	15	9	11	6	4	27,825	203	198	193	178	95%	90%	79	57
Ft. Collins Dist. Total	19	10	14	9	5	62,248	317	389	299	349	95%	90%	128	70
Logan	5	1	1	1	3	27,693	20	80	20	0	100%	-	6	NR
Morgan	4	-	2	4	2	14,549	80	18	52	14	65%	78%	-	40
Phillips	4	-	2	2	2	11,783	9	10	3	8	33%	80%	-	NR
Sedgwick	3	1	0	1	1	7,062	3	2	3	0	100%	-	-	NR
Washington	2	-	0	-	-	7,928	0	0	-	-	-	-	-	NR
Yuma	4	1	2	1	1	12,767	14	16	13	7	93%	44%	80	144
Ft. Morgan Dist. Total	22	3	7	9	9	81,782	126	126	91	29	72%	23%	86	184

Table 1, continued:

DED HISTORY

Counties * by CSFS District	# Critical Areas	Program				Elm Population In Critical Areas 1979	Confirmed DED Cases		DED Cases Removed or Properly Treated		Percent Removed/ Cases		Other Removals	
		Control Eff. '78	'79	Active '78	'79		'78	'79	'78	'79	'78	'79	'78	'79
Jefferson Co./ District	7	3	3	1	1	48,088	48	31	43	29	91%	93%	11	NR
Delta	1	-	1	1	0	3,187	0	0	-	-	-	-	-	2
Garfield	1	-	-	1	1	3,389	0	0	-	-	-	-	-	NR
Mesa	3	1	1	2	2	19,825	12	5	12	4	100%	80%	14	283
Rio Blanco	2	1	1	1	1	2,533	0	0	-	-	-	-	-	NR
Grand Junction Dist. Total	7	2	3	5	4	28,934	12	5	12	4	100%	80%	14	285
Bent	1	1	-	-	1	11,657	1	0	1	-	100%	-	5	NR
Cheyenne	1	1	1	-	0	4,065	0	1	-	1	-	100%	11	NR
Crowley	3	1	1	2	2	7,664	0	8	-	3	-	37%	54	NR
Las Animas	1	1	-	-	1	4,578	0	0	-	-	-	-	-	NR
Otero	6	2	1	3	4	42,034	94	153	65	43	69%	28%	103	221
Prowers	4	-	1	1	0	31,648	9	2	5	0	56%	0%	2	NR
LARK Dist. Total	16	6	4	5	8	101,646	104	164	71	47	68%	29%	175	221
Elbert	2	1	2	1	0	3,359	0	0	-	-	-	-	0	NR
El Paso	6	5	5	1	1	97,304	128	20***	123	20	96%	100%	116	351***
Kit Carson	4	2	2	2	2	14,977	10	4	9	0	90%	-	14	NR
Lincoln	2	2	1	-	1	11,691	0	2	-	0	-	-	4	NR
Woodland Park Dist. Total	14	10	10	4	4	127,331	138	26	132	20	96%	77%	134	351
State of Colorado	122	49	55	41	-	955,688**	1566	1474	1429	1001	91%	68%	1542	1564

* Only counties with critical areas are listed.

** There are 1 million elms outside the critical areas.

*** Colorado Springs removed 351 symptomatics without benefit of culture.

NR No Report

Table 2. FEDERAL DUTCH ELM DISEASE CONTROL DEMONSTRATION PROJECT

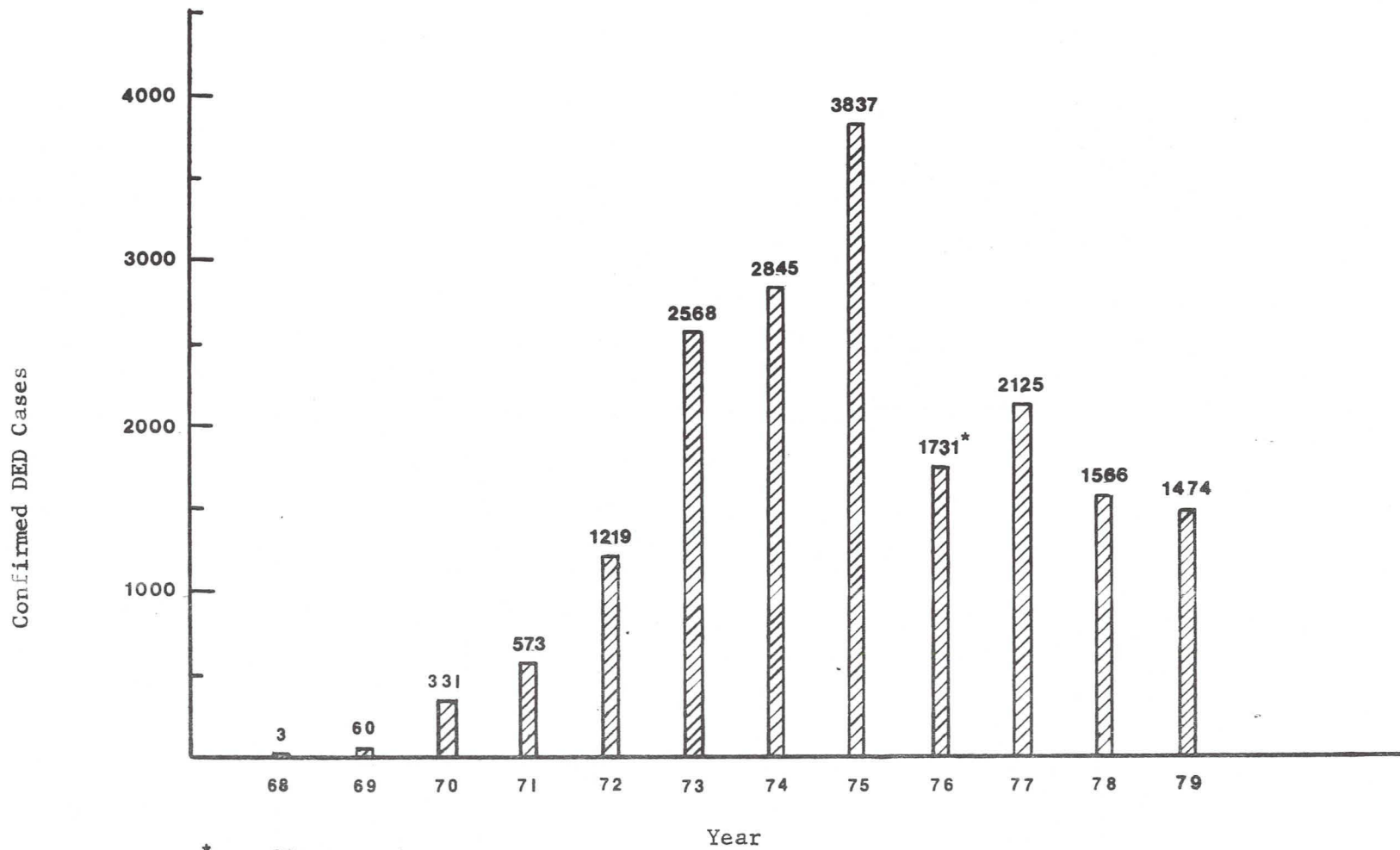
Area	1979 Elm Population	Large-Leaf Elm Population	Confirmed Cases <u>1/</u> 1978 1979		Broodwood Removals <u>3/</u> 1978 1979		Confirmed-Case Loss Rate				Total Loss Rate Confirmed Cases & Broodwood			
							% Total Elm Population		% Large-Leaf Elm Population		% Total Elm Population		% Large-Leaf Elm Population	
			1978	1979	1978	1979	1978	1979	1978	1979	1978	1979	1978	1979
Canon City	19,892	5,426	188	295	19	215	0.9	1.5	3.3	5.4	1.0	2.6	3.5	8.0
Eaton	2,053	125	47	6	3	26	2.2	0.3	22.4	4.8	2.2	1.6	22.4	6.4
Grand Junction	19,631	454	12	4	14	282	0.06	0.02	2.6	0.9	0.1	1.5	5.7	9.0
La Junta	23,005	4,258	51	21	84	218	0.2	0.1	1.1	0.5	0.6	1.0	2.7	1.9
Yuma	4,869	413	10	7	78	144	0.2	0.1	2.4	1.7	1.8	3.1	2.6	1.9

(1) Elms more susceptible to DED (such as American, English and Rock) as opposed to the small-leaved, less susceptible varieties (such as Siberian and Chinese).

(2) Confirmed by laboratory diagnosis.

(3) Non-diseased trees removed to eliminate beetle breeding sites.

CONFIRMED DUTCH ELM DISEASE CASES
IN COLORADO



*Insufficient data

Figure 1

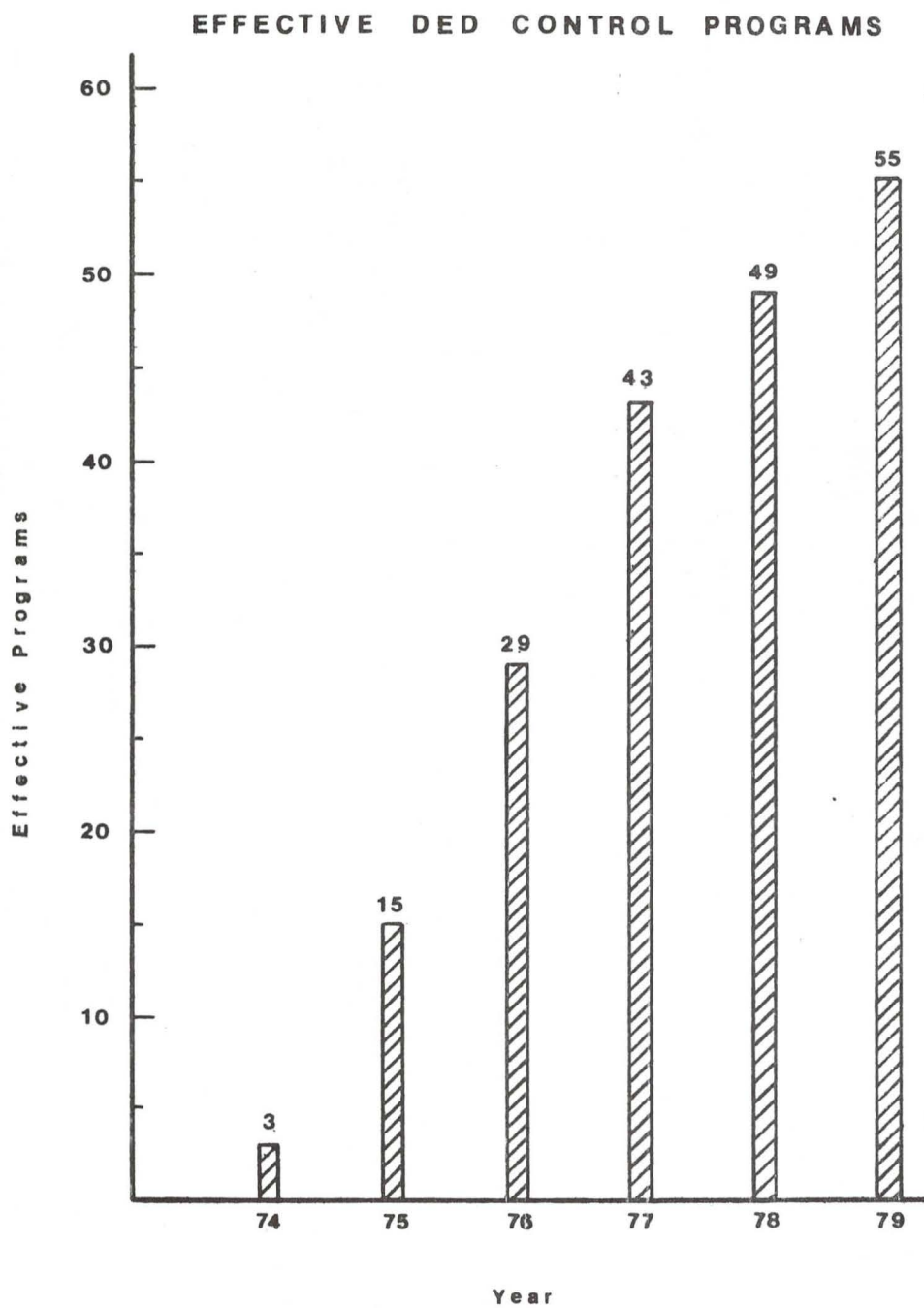


Figure 2

COLORADO

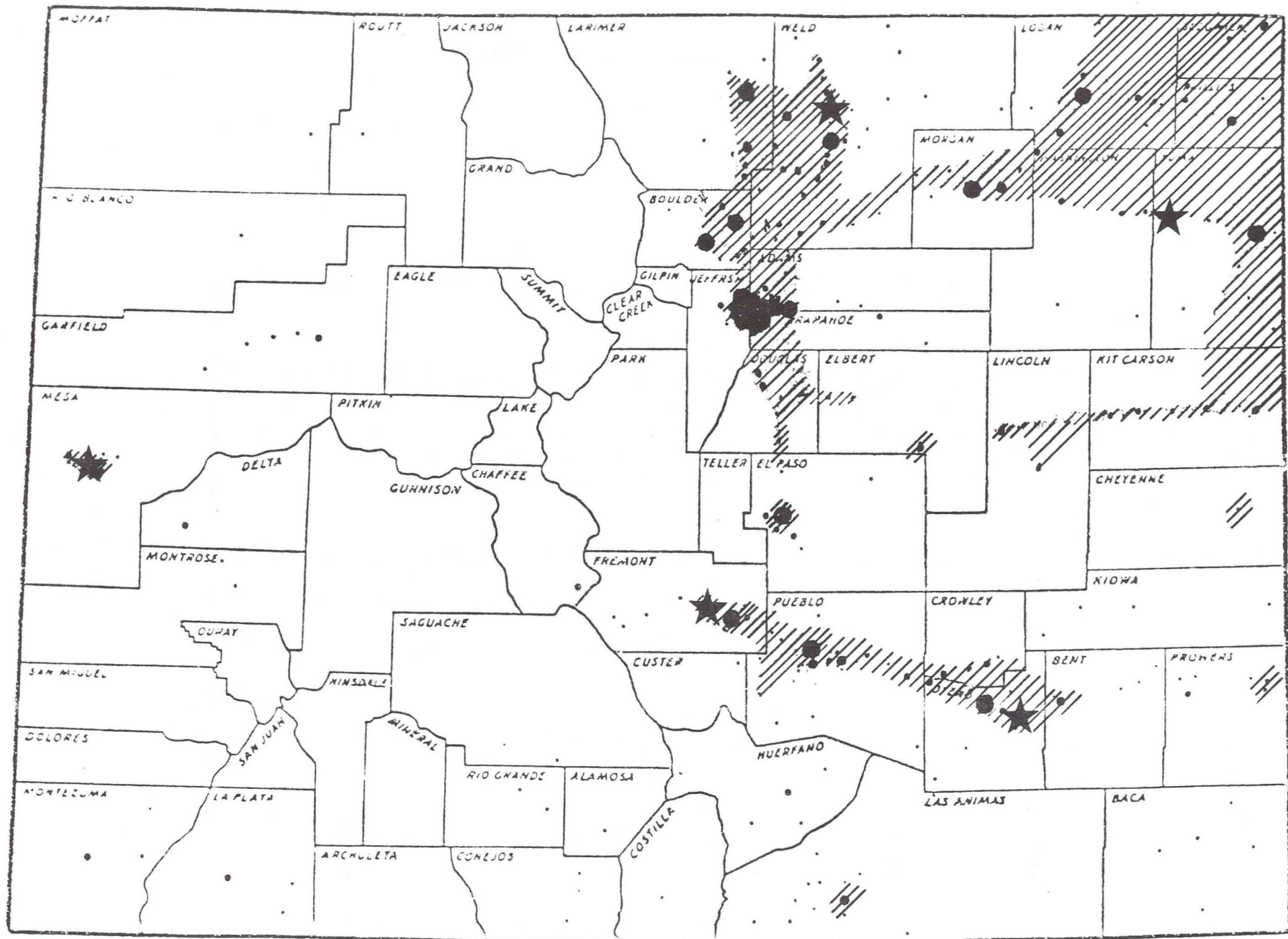


Figure 3 Dots indicate municipalities surveyed for Dutch elm disease (DED)
 Shaded areas are those from which positive cases of DED have been recorded
 ★ Areas participating in Federal demonstration control program

Five confirmations of DED were made on the campus in 1978; of these two had been treated with MBC-P in 1977. One elm was 63 cm in diameter, and received 130 liters of 424 ppm MBC-P solution. The other received 170L of the same solution and was 86 cm in diameter. Bioassay indicated the distribution was good to excellent over most of the crown. No injections were made in 1979. CSFS continued to monitor results of the previous injections. Five cases of DED were also confirmed on the CSU Campus in 1979, two of which had had prophylactic treatments. One was treated in 1977 and the other in 1978. The City of Colorado Springs treated 139 elms in 1978 and another 48 elms in 1979. However, no chemical distribution data or loss data are available as of this writing.

3. Chemotherapeutic Treatments

Eight elms were treated with Arbotech (TM) in Larimer County as curative treatment in 1978. All of these were lost in 1979.

4. Pheromone Trapping of *Scolytus multistriatus*

No reduction in beetle populations is indicated after five years of city-wide *Scolytus multistriatus* trapping in Fort Collins. In addition, DED losses do not appear to be influenced by trapping techniques applied in this area. Losses more closely reflected fluctuations in sanitation activities.

In view of these results, mass trapping will be discontinued. However, survey traps will be maintained in Fort Collins, Greeley and Loveland to monitor the beetle population.

The following table illustrates the trapping data from 1974 through 1979.

Scolytus multistriatus Trapping (Pheromone) in Fort Collins

<u>Year</u>	<u># Traps</u>	<u># <i>S.m.</i> Caught</u>	<u>Total # DED Cases (including CSU)</u>
1974	0	0	148
1975	2200	1.5 MM	90
1976	685	2.0 MM	132
1977	650	2.4 MM	108
1978	900	4.5 MM	70
1979	900	6.8 MM (est.)	117

J. Environmental Problems --

1. Drought stress accounts for the majority of environmental stress problems throughout Colorado (mainly on the east slope). Numerous species are affected mainly in urban ornamental and windbreak plantings.
2. The accumulation of salts continues to be a problem in Mesa County with many species damaged.
3. A myriad of chemical-related damage was reported from throughout the state frequently related to "weed and feed" type fertilizers.

During a survey of Siberian elms in eastern Colorado, it was noted that every windbreak visited displayed excessive herbicide damage. The most outstanding symptom was extremely elongated rubbery branches with small deformed leaves (elms that appeared like weeping willows). This damage was attributed to drift from aerial spraying of crops.

4. One small area in Douglas County reported heavy defoliation in a hailstorm in 1978.
5. Frost damage was reported throughout Colorado in spring 1979 resulting in delayed growth.
6. Winter drying also was reported as a 1979 problem throughout Colorado with heavy damage and some mortality reported in southeast Colorado and Grand County.

II: FOREST INSECTS

A.1 Defoliators -- Hardwoods

SHORT-HORNED GRASSHOPPERS (Family Acrididae):

In both 1978 and 1979, extensive defoliation of all plants, including trees, occurred throughout the central United States. Windbreaks in eastern Colorado suffered noticeable damage. Among those hosts supporting high grasshopper populations were cottonwood, Siberian elm, and lilac.

COTTONWOOD LEAF BEETLE (*Chysomela scripta*):

Locally heavy defoliation was detected near Sterling (Logan County), Boulder, Fort Collins and Fort Morgan. In all cases, damage was to isolated ornamentals or groups of trees growing near water.

ELM LEAF BEETLE (*Pyrrhalta luteola*):

Probably the most widespread and common hardwood defoliator in Colorado, this pest again caused variable degrees of elm defoliation state-wide below 7500'. Areas reporting high or increased populations in 1978 were: Boulder District; Durango District, especially Cortez; Grand Junction District; Denver District; Fort Collins District, especially Greeley; and Canon City District. As usual damage was heaviest to Siberian elm, and became most noticeable in mid-summer. Supporting this, the Weld County Pest Inspector received 20 of his 24 requests for elm leaf beetle assistance in July and August. 1979 populations, particularly on the eastern plains, were noticeably lower.

Other elm leaf beetle habits -- over-wintering as adults in large groups, and entering homes or other sheltered places -- also continue to cause homeowners concern.

Phenological Note: ELB egg masses, Aurora (Denver area),
5/22/79.
ELB egg masses and young larvae common
in Wray, 6/15/79.

MOURNING CLOAK BUTTERFLY or SPINEY ELM CATERPILLAR (*Nymphalis antiopa*):

Locally common but rarely damaging, this insect was reported from Wellington (Larimer County), Canon City, Alamosa, Fort

Collins and La Junta. The gregarious nature of feeding caterpillars can rapidly defoliate small ornamentals. Hosts include elm and willow.

NEVADA BUCK MOTH (*Hemileuca nevadensis*):

A local population caused light defoliation of mature ornamental and pole-size windbreak cottonwoods about 13 miles north of Laird (Yuma County). Laboratory-reared larvae pupated in late summer.

FALL WEBWORM (*Hyphantria cunea*):

Late summer defoliation of poplars, chokecherry, willow and other minor hosts was again common in Wray, Yuma and Grand Junction. Noticeable non-urban infestations occurred along the Arkansas River between Buena Vista (Chaffee County) and Canon City, and in Phantom Canyon (Fremont County).

Phenological Note: First webs of year noted on cottonwood 7/8/79, Windsor (Larimer County).

AMERICAN DAGGER MOTH (*Acronieta americana*):

Silver maples along the northern Front Range annually host this late summer feeder. A particularly conspicuous population caused early leaf drop in Berthoud in both 1978 and 1979. In the process of consuming leaf tissue, caterpillars apparently severed leaf petioles. Finding fallen leaves with very short petioles (1/8 to 1/4" long) was a good indication of feeding American dagger moth larvae in crowns above. Most clipped leaves also showed normal scallop-type defoliation.

REDHUMPED CATERPILLAR (*Schizura concinna*):

Apparently increased in number from past years, the redhumped caterpillar was reported from ornamental fruit trees and willow thickets. Peak Fort Collins area feeding was in September, causing minimal damage. Only one report was received in 1978 (Fort Collins on apple).

WESTERN TENT CATERPILLAR (*Malacosoma californicum*):

Major outbreaks in aspen still exist near Apishapa Pass (Las Animas County), and Chromo (Archuleta County). Some top-kill and mortality is evident in both areas. The Apishapa Pass outbreak covers 5000 acres and is now in at least its fifth year. The Chromo outbreak includes 16,000 acres of private

and San Juan National Forest land near Buckles Lake and V-Rock, including parts of Banded Peak Ranch. A biological evaluation of the Chromo infestation was done by the USFS, R2 personnel in 1979 (R2-79-10) and some type of control operation utilizing *Bacillus thuringiensis* is being considered for June 1980. Summer 1979 egg mass counts predict heavy defoliation in 1980.

Significant decreases in other outbreak populations at La Veta Pass and Pass Spring Creek (both Huerfano County) occurred in 1979. Branch and whole-tree mortality in these areas are presently uncommon and local. Apparently, most trees in these former outbreaks have survived repeated near-complete defoliation. As reported in 1977, late-summer re-foliation was common.

Static, local outbreaks continued just west of Woodland Park (Teller County), on the Uncompahgre Plateau (Montrose County) and near Cumbres Pass (Conejos and Archuleta Counties).

Minor defoliation of chokecherry, buck brush and other understory hosts was common state-wide.

Phenological Note: First tents noted on buck brush, 4/28/78, Buckhorn Canyon (Larimer County); on chokecherry throughout Boulder County, 5/1/79.

FOREST TENT CATERPILLAR (*Malacosoma disstria*):

Primarily an urban tree pest in Colorado, 1979 populations appeared to be at or below 1978 levels. On the Colorado State University (CSU) Campus in Fort Collins, egg masses under observation began hatching 4/21/79 (bud break was 4/6/79). These colonies were severely decimated by a late-spring snowstorm, May 5 and 6, 1979. Perhaps this explains the "decreased" damage reports from the Front Range cities north of Denver. Members of the summer's usual second generation were hard to find.

A TORTRICID LEAFROLLER COMPLEX (*Archips* spp. and *Choristoneura* spp.):

Several species of leafrollers, including ugly-nest caterpillar, fruit-tree leafroller, oblique-banded leafroller, and large aspen tortrix were found state-wide causing light to moderate defoliation of various hardwoods. Of note were undetermined species on Gambel oak and boxelder in the Durango area.

Phenological Note: Fruit-tree leafroller (and possibly other species) adults emerged in Fort Collins 7/10/79.
Mature ugly-nest caterpillar larvae collected from Loveland in early-July; emerged as adults in lab 7/11/79.

COTTONWOOD (ASPEN) BLOTCH MINER (*Phyllonorycter tremuloidiella*):

Late-summer browning of cottonwoods in eastern Colorado and locally on the west slope was often due to this insect. An undetermined disease complex thought to involve cytospora canker and bacterial wetwood organisms causes similar symptoms. This makes determination of miner damage severity and extent difficult in the absence of specific surveys. Specific reports of damage came from Alamosa, Gunnison and Steamboat Springs. The same or related moth makes unsightly blotch mines on willow and narrow-leaf cottonwood foliage state-wide, also in late-summer.

ANTS (Family Formicidae):

An undetermined species of ant, probably in the harvester group, defoliated various species of hardwood seedlings planted as windbreak stock on the Fort Morgan District. This is thought to be a normal annual occurrence in eastern Colorado. Avoid tree planting in areas having active harvester ant mounds where possible.

MISCELLANEOUS HARDWOOD DEFOLIATORS: (See Table 3.)

Table 3. MISCELLANEOUS HARDWOOD DEFOLIATORS

Common Name	ash	caragana	elm	lilac	oak	poplars	prunus	willows	others	Comments/Location
a walking stick										host unknown/Bonny Reservoir
a katydid								x		eggs on twig/Grand Junction
ashgray blister beetle		x								shelterbelt seedlings/Fort Morgan
a willow leaf beetle								x		saplings near water/state-wide
locust leaf miner									x	black locust/north of Laird
<i>Euura</i> borer						x				cottonwood/Bonny Reservoir
a birch blotch miner									x	water birch/Pass Creek
pear slug							x			fruit trees/northern Front Range
an alder sawfly							x		x	alder/Pass Creek
poplar leaf-folding sawfly							x			cottonwoods/eastern Colorado
western tiger swallowtail	x									green ash ornamentals/state-wide
Weidemeyer's admiral butterfly						x		x		saplings/Fort Collins
viceroy butterfly								x		saplings near water/Fort Collins
big poplar sphinx						x				mature tree/north of Laird
cecropia moth			x						x	ornamentals/Front Range
Glover's silk moth								x	x	saplings/Durango & Fort Collins
polyphemus moth			x					x	x	especially red stem dogwood/Front Range
io moth								x		saplings/Larimer County
green fruit worm			x				x		x	ornamentals/state-wide
poplar tent-maker						x				aspen ornamentals/Fort Collins
unicorn caterpillar			x						x	ornamentals/Front Range & Durango
yellow & black Halisidota								x	x	willow & alder/Durango
sonoran tent caterpillar					x					Gambel oak/southern Colorado
a cankerworm			x							Siberian elm/northeastern Colorado
linden looper					x				x	Gambel oak & various ornamentals/state-wide
elm spanworm									x	boxelder/Fort Collins
ugly-nest caterpillar					x		x			"weed" trees/state-wide
aspen leaf miner							x			aspen/locally state-wide
lilac leaf miner				x						ornamentals/Front Range
hackberry butterfly									x	hackberry ornamentals/Front Range
a yellow buck moth								x		saplings near water/Fort Collins & Big Thompson

Phenological Note: Io and cecropia moth larvae active and nearly mature in willow thickets, Warren Lake (Fort Collins), late-August to early-September, 1979. A willow leaf beetle (*Calligrapha bigsbyana*) actively laying eggs on willow, Warren Lake (Fort Collins), early-September, 1979.

A.2 Defoliators -- Softwoods (conifers)

SHORT-HORNED GRASSHOPPERS:

Eastern Colorado tree hosts for these general feeders in 1978 and 1979 included Scots, Austrian and ponderosa pine; spruce; and eastern redcedar.

PINE BUTTERFLY (*Neophasia menapia*):

The only known recent outbreak, on approximately 100 acres seven miles north-northwest of Calhan (Elbert County), collapsed in 1978. Very few feeding larvae were found during a 6/11/79 inspection of the area. However, several ponderosa pines within the infestation are now dead or being killed by bark beetles. The latter are presumably attacking in response to pine butterfly-induced host vigor reduction.

Quantification of this bark beetle mortality is scheduled for early-summer 1980.

Phenological Note: 6/11/79, Calhan, caterpillars predominantly instars 1-3, a few 4. Some eggs just hatching.

PANDORA MOTH (*Coloradia pandora*):

If historical patterns repeat themselves, this insect should soon reappear as an important forest pest. Colorado outbreaks have been spaced 20-30 years apart with the last one occurring in the late 1950's. For this reason all reports of pandora moth in 1978 and 1979 were given serious attention. A moth was found in Dillon (Summit County) and larvae were defoliating ornamental lodgepole pine near Walden (Jackson County). Neither incidence was found to be important. Specific detection efforts will commence in northern Colorado lodgepole forests in 1980.

BLACK HILLS PANDORA MOTH or relative (*Coloradia doris* (?)):

Since 1977 a small population on ponderosa pine has been observed on the east side of Horsetooth Reservoir just north of Spring Canyon Dam (Larimer County). Defoliation has been light. Life history studies will be continued in 1980 and observations published. This insect, if in fact the Black Hills pandora moth, is reported to have reached epidemic status in South Dakota in 1938-39.

A PINE TIGER MOTH (*Halisidota ingens*):

In 1978 numerous observations of this upper crown tent-maker were brought to our attention. Ponderosa pine was the usual host, although pinon and lodgepole pines, Douglas-fir and even white fir were attacked. Concentrations in excess of 10 trees per acre in both ponderosa and pinon pines were typical of forests in Las Animas County from New Mexico north to the Spanish Peaks and from Stonewall east to Trinidad (see Figure 4). Other reports came from Sugarloaf (Boulder County), Phantom Canyon (Fremont County), north of Cedar Park (Larimer County), Red Feather Lakes (Larimer County), Dinosaur National Monument (Moffat County) and Hermosa (La Plata County).

The heavy populations of 1978 collapsed prior to 1979. Only one active tent, in central Boulder County, was found last year. Both tachnid flies and an unknown disease are thought to have contributed to this rapid change in status, as both were observed regulating individual tents during the 1978 southern Colorado outbreak. During two years, very little lasting damage occurred to host trees.

DOUGLAS-FIR TUSSOCK MOTH (*Orgyia pseudotsugata*):

Serious defoliation of mature, ornamental Colorado blue spruce and other less-common conifer hosts continued in Denver and Colorado Springs. A specific evaluation of Colorado Springs, however, showed a much lower level of damage and incidence than in 1977 (see Figure 5.) Pheromone trapping of forest populations did not take place in 1978 or 1979, but a lack of damage reports from these regions would indicate the Douglas-fir tussock moth remains quiet outside of Colorado's big cities.

Distribution and Relative Abundance
of Pine Tiger Moth (*Halisidota ingens*)
Las Animas County, Colorado - 1978

LAS ANIMAS COUNTY

● Infested Douglas-fir

★ Infested pinyon pine, less than 10
per acre

★ Infested pinyon pine, more than 10
per acre

■ Infested ponderosa pine, less than 10
per acre

■ Infested ponderosa pine, more
than 10 per acre

Scale 0 10 20 30 40 Miles
Contour interval 500 feet
6th PM

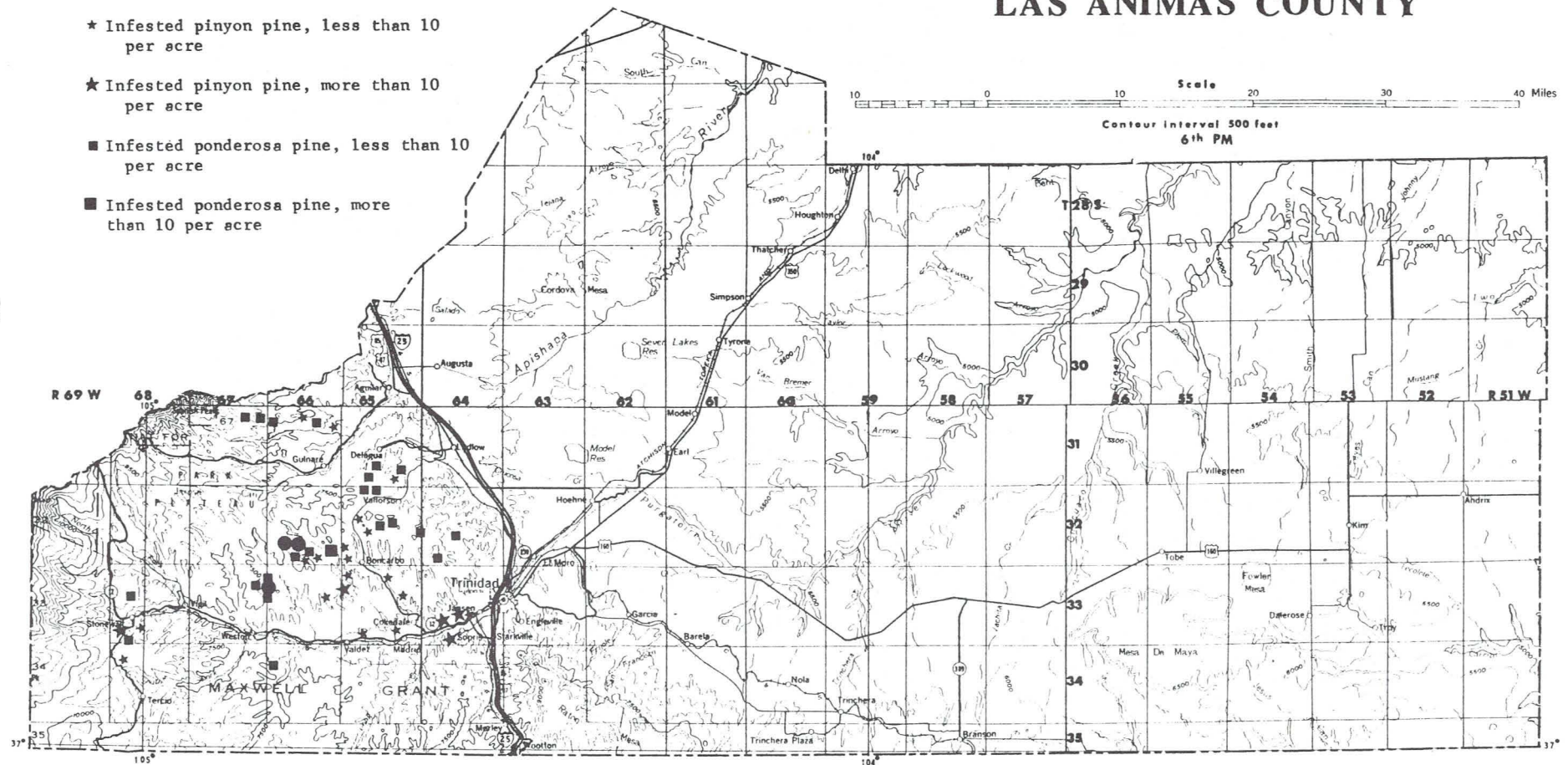


Figure 4

1978 AND 1979 -- COLORADO SPRINGS DOUGLAS-FIR TUSSOCK MOTH INCIDENCE

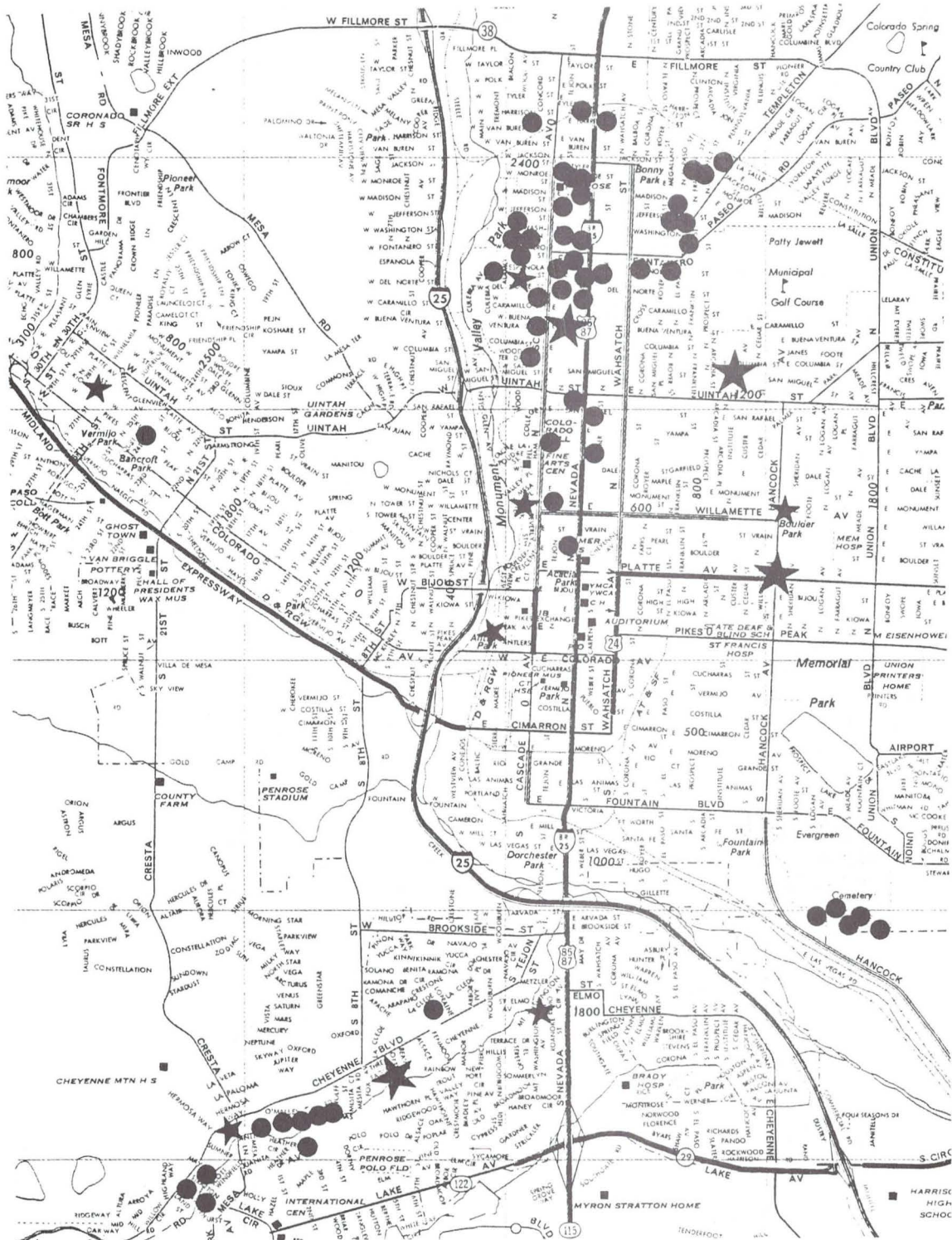


Figure 5.

● Current (1979) infestation. Each dot indicates a single tree or small group (2-5 trees).

★ General areas of old (1978 or older) infestation, as evidenced by dead tops, missing tops, or thin foliage.

Phenological Note: 5/22/79, Aurora (Denver area), egg masses hatching.
6/12/79, Colorado Springs, tussock moth larvae predominantly 1-3 instars.

WESTERN SPRUCE BUDWORM (*Choristoneura occidentalis*):

Western spruce budworm continues to be the most extensive and damaging conifer defoliator in Colorado. USFS estimates place infested acreages at over 900,000 acres for both 1978 and 1979. Douglas-fir is most commonly attacked, followed in decreasing importance by white fir and other true firs, Engelmann spruce and other spruces, and rarely pines.

The Colorado State Forest Service (CSFS) has been actively involved in giving private landowners technical assistance in understanding and controlling budworm. This insect is second only to mountain pine beetle in the amount of homeowner interest and concern generated. Public assistance given includes: (1) biological information including specific egg mass and larval counts where requested; (2) trend information as generated from above activities and monitoring of data from permanent plots; (3) evaluations of pre- and post-spray conditions; (4) control option information including names and costs of available pesticides and applications; and (5) coordination of control operations on multi-ownership blocks.

Among the more troublesome infestations in terms of interference with landowner objectives for the forests or trees involved include:

- ... Estes Park and surrounding valley (Larimer County);
- ... mountainous portions of Boulder County including:
 - Big John Mountain near Allenspark,
 - Flagstaff Mountain area west of Boulder, and
 - from Raymond to Riverside along South St.Vrain Creek;
- ... Evergreen and Conifer areas (Jefferson County);
- ... Jarre Canyon (Douglas County);
- ... Ute Pass (El Paso County);
- ... Wet Mountains from Rye to Canon City (Pueblo, Custer and Fremont Counties);
- ... triangle from La Veta Pass southwest to Fort Garland east to Cuchara (Huerfano and Costilla Counties); and
- ... Vallecito Reservoir Area (La Plata County).

Table 4. WESTERN SPRUCE BUDWORM SAMPLING (1978-1979)

Area 1/	CSFS 2/ Dist.	Sprayed 3/ 1978?	Defol. 4/ Rating	Date	1978 Egg Mass Sampling			1979 4/ Def. 1/ Predict	1979 Larval Sampling				Sprayed 1979?	Defol. 4/ Rating	Date	1979 Egg Mass Sampling			1980 4/ Def. 1/ Predict
					# New Masses 5/	# New Masses/M Sq. In. Foliage	1979 4/ Def. 1/ Predict		# Buds 8/	% Live Larvae	% Infested	# New Masses 5/				# New Masses/M Sq. In. Foliage	1980 4/ Def. 1/ Predict		
Estes-DG	FC	N	4	8/24	225	11.4	3	-	-	-	-	N	3-4	-	-	-	-		
Estes-DH	FC	Y	3	8/25	89	4.3	2	6/6	823	29	3.5	N	2	-	-	-	-		
Estes-HP	FC	Y	2	8/25	18	1.0	1	6/7	-	-	est. 5.0	Y	1	8/17	35	1.5	1-2		
Estes-ML	FC	N	?	-	-	-	-	6/7	-	-	est. 10.0	N	3	8/17	211	10.5	3		
Estes-W	FC	Y	2	-	-	-	-	6/6	574	9	1.5	N	2	-	-	-	-		
Estes-nW	FC	N	?	-	-	-	-	-	-	-	-	N	3	8/17	365	17.9	3		
Glen Haven	FC	N	?	-	-	-	-	6/6	606	175	28.9	Y	?	-	-	-	-		
pre-Balarat	B	N	3	-	-	-	-	6/11	504	148	29.4	(Y)	-	-	-	-	-		
post-Balarat	B	N	-	-	-	-	-	6/29	1786	16	0.9	Y	2	-	-	-	-		
Raymond	B	N	3	-	-	-	-	6/7	802	177	22.1	N	2-3	-	-	-	-		
Aspen Park	G	N	?	-	-	-	-	-	-	-	-	-	3	8/8	189	9.2	3		
Bear Mt.	G	Y	2	-	-	-	-	-	-	-	-	Y	1-2	8/8	16	0.7	1		
JeffCo.	G	Y/N	-	-	-	-	-	6/5	3476	92	2.6 6/	Y/N	-	-	-	-	-		
Richman Hills	G	N	?	-	-	-	-	-	-	-	-	N	3	8/8	207	9.6	3		
Soda Creek	G	N	?	-	-	-	-	-	-	-	-	Y	2	8/8	47	2.1	1-2		
Perry Park	Den	N	2	8/23	58	2.9	2	6/11	511	42	8.2	N	2	8/9	103	5.1	2-3		
Perry Park	Den	N	2	-	-	-	-	6/11	503	114	22.7	N	2	-	-	-	-		
Forbes Park	A	N	2	8/1	289	21.6	3-4	6/22	1000	298	29.8	N	4	8/28	289	16.7	3		

(See next page for footnote explanation, legend and discussion.)

Notes on Table 4

- (1) Areas: DG = Devil's Gulch, DH = Dunraven Heights, HP = Hermit Park, ML = Mary's Lake, W = Windcliff Estates, nW = near Windcliff Estates (just south of), JeffCo = various locations within Jefferson County, pre-Balarat = pre-spray larval counts at Balarat, post-Balarat = post-spray larval counts at Balarat, Raymond = along road from Raymond to Riverside.
 (2) CSFS Districts: FC = Fort Collins, B = Boulder, G = Golden, Den = Denver and A = Alamosa.
 (3) Aerial application of registered materials (carbaryl (Sevin-4-Oil) or acephate (Orthene)).
 (4) Defoliation Classes (Rating) For

Current Growth	
Class	% Defoliation
1. Undetectable	0 to 5
2. Light	5 to 35
3. Moderate	35 to 65
4. Heavy	65 and over

- (5) Count of egg masses from two branches from mid-crown from each of 25 co-dominant trees (50 branches).
 (6) Larval sampling two weeks earlier indicated a bud infestation level of 5.8%. Snow and ice storms which occurred between sampling dates probably account for the decrease. This phenomenon could not be documented for mountainous regions of Boulder and Larimer Counties, where double larval sampling was performed.

- (7) Class Limits for Sequential Sampling Plan (from McKnight, et.al, 1970)

Class	New Egg Masses Per 1,000 ² in. Foliage	Defoliation Prediction
1.	1.0 or fewer	Undetectable.
2.	1.1 to 4.0	Undetectable in "static" infestations, light in "increasing" infestations.
3.	6.0 to 20.0	Light in "static" infestations, moderate in "increasing" infestations.
4.	22.0 or more	Moderate or heavy.

- (8) Arbitrary sampling minimums were set at 500 buds from at least five trees.

Types of damage reported for these areas included:

- ... loss of aesthetic qualities including property value reduction;
- ... growth loss;
- ... loss of market value of hosts as Christmas trees, boughs, and transplants;
- ... branch, top, and whole-tree mortality; and
- ... recreational losses due to larval nuisance.

Phenological Note: First active larva of season seen resting on terminal bud, Wild Basin (Boulder County, elevation 8500'), 5/17/79. Later than usual.

5/28/79: Young (II and III instars) predominately in old needles (mining) and buds at Glen Haven and Estes Park (both Larimer County), Raymond to Riverside (Boulder County, 7800'). Douglas-fir bud burst was week of 6/4 for those areas. Spruce bud burst was week of 6/11. Douglas-fir bud burst observed in Lower South St. Vrain Canyon five miles west of Lyons, 6100', 5/28/79.

6/15-22/79: Instars III-V predominate along foothills (4500-6500' elevations) from Fort Collins to Denver. Properly-timed spraying occurred. Later than "normal" year.

7/3/79: Near Jamestown (Balarat, 7500'), pupae were predominate stage. A few adults observed.

PONDEROSA NEEDLE MINER (*Coleotechnites ponderosae*):

Needle miner damage in 1979 was much less visible than 1978. This may have been the indirect result of abnormally high 1979 winter and spring moisture. Good new needle growth could have masked attacks and subsequent discoloration of old needles.

No new infestations were detected in 1978 or 1979. Major areas of concern continue to be most of Boulder County below 8000', Coal Creek Canyon (Jefferson and Boulder Counties), Elizabeth (Elbert County), and Colorado Springs.

CSFS personnel are assisting Rocky Mountain Forest and Range Experiment Station (RMFRES), U. S. Forest Service personnel with control tests of ponderosa needle miner. Both foliar sprays (early-summer) and trunk implants (fall and early-summer) of acephate will be evaluated with registration of effective treatment methods one study goal. Twelve pine trees on Flagstaff Mountain, Boulder Mountain Park, were implant treated on 9/5/79. Results will be measured in early-summer and fall 1980.

In 1978, CSFS sampled over 200 trees hoping to determine if needle miner attacks have measurable effects on radial growth, and thus overall vigor. Previous observations indicated that within ponderosa pine stands infestation levels of individual trees vary greatly. Selection of trees for increment coring was purposely biased so that 25 heavily infested and 25 lightly infested trees were sampled. These determinations were made visually. All trees selected were open grown. In addition lower crown foliage samples were taken to determine actual infestation rates for the two visual classes. Table 5 summarizes this data. In at least one sample area, there was a significant difference in radial growth between light and heavily infested trees. Preliminarily, it appears ponderosa needle miner infestations reduce tree growth. The affect this has on mountain pine beetle susceptibility is not known.

WHITE FIR NEEDLE MINER (*Epinotia meritana*):

The only known Colorado outbreak which began in 1972 has subsided. This 9500-acre infestation north of La Veta Pass in the Pass Spring Creek drainage (Huerfano County) is now characterized by heavy white fir mortality. Many of the surviving fir display a curious "paint brush" condition -- the extreme upper crown is alive, the mid-crown largely bare and lower crown partly alive.

In 1973 the USFS established 20 permanent plots on private land within the infestation. CSFS and USFS personnel jointly revisited these plots in 1978 and 1979. Data is summarized in Table 6. The white fir needle miner, in combination with western spruce budworm, has now shown the capability of causing higher levels of host mortality than previously documented. Fortunately, the stands of Pass Spring Creek contain a maximum mix of coniferous species. While white fir is an important component of those stands, the hillsides are by no means denuded when white fir is removed. Dead trees in most stands are now "jackstrawed" creating a barrier to

Table 5. EFFECT OF PONDEROSA PINE
NEEDLE MINER ON RADIAL GROWTH

Sampling Location	# Trees	Infestation * Class	Radial Growth Increment	Average Radial Growth (mm)	Std. Dev.	Signif. Diff.
Flagstaff Mt.	24	L	Last 5 yrs.	7.08	3.06	> Yes
"	22	H	Last 5 yrs.	5.41	2.54	
"	24	L	Last 10 yrs.	17.58	7.58	> Yes
"	22	H	Last 10 yrs.	12.09	5.52	
Lefthand Canyon	25	L	Last 5 yrs.	7.24	3.23	> No
"	25	H	Last 5 yrs.	7.72	2.81	
"	25	L	Last 10 yrs.	20.84	7.03	> No
"	25	H	Last 10 yrs.	21.48	6.70	
Coal Creek Canyon	17	L	Last 5 yrs.	6.65	2.50	> No
"	33	H	Last 5 yrs.	6.79	2.46	
"	17	L	Last 10 yrs.	15.35	5.61	> No
"	33	H	Last 10 yrs.	16.52	6.26	
Elizabeth	25	L	Last 5 yrs.	6.72	3.03	> No
"	25	H	Last 5 yrs.	7.72	3.19	
"	25	L	Last 10 yrs.	13.20	5.07	> No
"	25	H	Last 10 yrs.	14.48	5.19	

*

Infestation Classes		"Light"		"Heavy"	
Location	# Old Needles Examined	Ave. % Infested	/Branch Infestation Range	Ave. % Infested	/Branch Infestation Range
Flagstaff	2700	3.2	0 - 11	49.2	26 - 69
Lefthand	2400	5.5	2 - 15	68.6	43 - 81
Coal Creek	1800	18.8	3 - 41	50.2	17 - 83
Elizabeth	2400	5.7	0 - 19	63.9	24 - 85

grazing cattle and greatly increasing fire hazard. Because the area is largely used for ranching and residential development, both these miner-caused liabilities are important.

During earlier visits fir engraver attacks were thought to be an increasingly important member of Pass Spring Creek's pest complex. Recent plot examinations did not verify this.

White fir needle miner has clearly demonstrated that it can have serious impacts on the forest.

BULL PINE SAWFLY (*Zadiprion townsendi*);

While not detected in 1979, this defoliator of ponderosa pine was regularly found during 1978. It was more of a curiosity than a damaging pest because larvae actively feed on warm days throughout the winter. One report came from a living room Christmas tree. Recorded locations include Pinebrook Hills and near Jamestown (both Boulder County), Black Forest (El Paso County), Breen (La Plata County), east side of Apishapa Pass (Las Animas County), and north of Palmer Lake (Douglas County).

OTHER PINE SAWFLIES (*Neodiprion fulviceps*, *gillettei* and *rohweri*):

Scattered Austrian and ponderosa pine windbreak rows in Logan, Washington, Phillips, Pueblo and Lincoln Counties suffered moderate defoliation. Small, insignificant infestations occurred in natural ponderosa pine stands at Horsetooth Reservoir, Norfolk and Rist Canyon (all Larimer County).

MISCELLANEOUS SOFTWOOD DEFOLIATORS: (See Table 7, p. 35.)

B.1 Sucking Insects and Mites -- Hardwoods

ASH PLANT BUG (*Tropidosteptes (Neoborus) amoenus*):

Probably common state-wide on ornamental ash, specific cases of mottled-type leaf damage were observed in Fort Collins and extensively in Grand Junction.

Another unidentified plant bug discolored foliage of single-leaf ash (*F. anomala*) along Rim Drive in Colorado National Monument west of Grand Junction.

Table 6. COMPARATIVE SUMMARY OF WHITE FIR
NEEDLE MINER AND WESTERN SPRUCE BUDWORM DAMAGE,
PERMANENT PLOTS SOUTH OF GARDNER, COLORADO, 1975 & 1978-79

A. White Fir Defoliation:

Defoliation Class ^{1/}	Total Crown				Upper 1/3 Crown			
	No. of Trees		% of Total		No. of Trees		% of Total	
	1975	1979	1975	1979	1975	1979	1975	1979
1	0	4	0	1	0	12	0	4
2	19	81	9	30	17	74	8	28
3	67	68	30	26	52	54	24	20
4	45	44	20	17	50	44	23	16
5	91	69	41	26	100	82	45	31
TOTALS	222 ^{2/}	266 ^{2/}	100	100	219 ^{2/}	266 ^{2/}	100	100

B. Permanent Damage:

	<u>No. of Trees</u>	<u>% of Total (390 trees)</u>
<u>White fir:</u>		
Whole-Tree Mortality	124	32
Top-Kill	58	15
Branch Mortality	53	14

	<u>No. of Trees</u>	<u>% of Total (44 trees)</u>
<u>Douglas-fir:</u>		
Whole-Tree Mortality	1	2
Top-Kill	10	23
Branch Mortality	7	16

- (1) Defoliation Classes (NOTE: Both whole crown and upper crown were rated.): 1 = less than 1% (none), 2 = 2-25% (light), 3 = 26-50% (moderate), 4 = 51-75% (heavy) and 5 = 76-100% (severe).
 (2) In 1975, only the 222 white fir greater than 6" dbh were examined. In 1978-79, all 390 white fir were examined, of which 266 were alive and 124 dead.

Table 7. MISCELLANEOUS SOFTWOOD (CONIFEROUS) DEFOLIATORS

Common Name	junipers	ponderosa pine	spruce	other pines	Comments/Location
chafers (scarabs)		x			state-wide, especially Alamosa & LARK Districts
pine budworm		x			especially along roads, in canyons/ Front Range
a pine tussock moth		x			ridge top trees/Horsetooth Reservoir
a gray pine false looper		x			ridge top trees/Horsetooth Reservoir
a yellow pine false looper		x			ridge top trees/Horsetooth Reservoir
juniper webworm	x				farmyard ornamentals/south of Haxtun
pinon needle miner				x	local, Meeker & south of Durango
a solitary web-spinning sawfly		x			ridge top trees/Horsetooth Reservoir
a spruce web-spinning sawfly			x		east of Colorado Springs
spruce needle miner			x		ornamental spruce/state-wide
elfin butterfly		x			Horsetooth Reservoir & Canon City
misc. weevils (<i>Magdalis</i> and <i>Scythropus</i>)		x			state-wide

GIANT WILLOW APHID (*Lachnus salignus*):

Most owners of mature willows, especially weeping willows, are familiar with "the purple aphid." Honeydew and the characteristic stain caused when aphids are crushed make this a real nuisance pest. Heavy populations exist in Steamboat Springs, Greeley, Fort Collins and Denver.

COTTONY MAPLE SCALE (*Pulvinaria innumerabilis*):

Detection efforts in 1978 and 1979 indicate the cottony maple scale is much more common than previously thought. In the northern Front Range, cottony scales were found on maple, boxelder, honeylocust, Ohio buckeye, American elm, green ash and hackberry. Durango also has a light infestation on American elm. Damage is slight, although the accumulative effects of all minor pests like cottony maple scale may be significant in urban environments.

OYSTERSHELL SCALE (*Lepidosaphes ulmi*):

Prevalent at lower elevations on ash, lilac, poplars, willow, elm and several other hardwood hosts. Extremely high numbers have contributed significantly to the deterioration of windbreaks and urban forests state-wide. This deterioration is not spectacular or rapid and thus, is often overlooked. Experience indicates urban forest spraying already being performed on a routine basis would be much more effective if properly timed for oystershell scale crawler control. Deadwood pruning costs could also be decreased.

AN ASH WOOLLY APHID (*Prociphilus* (?)sp.(?)):

During street tree surveys for lilac borer in Grand Junction in October 1979, occasional European ash trees supporting conspicuous woolly aphid colonies were found. The aphids were concentrated on the lower trunk. Their identity, habits and impact is unknown.

EUROPEAN ELM SCALE (*Gossypia spuria*):

These well-established imports are important as twig and branch killers and producers of honeydew. With Dutch elm disease being Colorado's most important urban tree problem, the confusion that scale "flags" cause DED

surveyors is important, especially in late summer. The contribution of scales to creating suitable elm bark beetle broodwood is unknown. Honeydew production is a nuisance to park users and pedestrians. Black sooty mold, associated with that honeydew, detracts from aesthetics values of American elm.

TWO-SPOTTED SPIDER MITE (*Tetranychus urticae*):

Increased mite populations occurred in several locations, often in conjunction with repeated, annual pesticide applications for defoliator control. Routine street tree spraying with broad-spectrum insecticides, particularly carbaryl, is done by many city forestry or parks and recreation departments. The mite situation the past two summers in Canon City and Grand Junction should dictate caution in pesticide selection and even need for application. Some ash and elms in the above cities literally took on a smoky or ghostly appearance because of mite webbing on all tree parts. Similar build ups in conifers are reported on page 38.

Table 8. MISCELLANEOUS HARDWOOD SUCKING INSECTS'

Common Name	alder	elm	oaks	poplars	willows	other	Comments/Location
oak lace bug			x				Gambel oak near Pagosa Springs
alder spittle bug	x						alder & water birch/Rustic, La Veta & Durango
buffalo tree hopper				x	x		saplings along river/Fort Collins
woolly elm aphid		x					ornamentals, street trees/state-wide
woolly apple aphid		x					ornamentals, street trees/eastern Colorado
European fruit lecanium (Brown apricot scale)		x				x	street trees, various hosts/ state-wide
a walnut aphid						x	walnut/Grand Junction (?)
boxelder bug						x	boxelder/state-wide

B.2 Sucking Insects and Mites -- Softwoods

A PINE FLAT BUG (*Aradus* (?) sp(?)):

In the process of conducting pre-and post-suppression surveys for mountain pine beetle, individual flat bugs were routinely discovered on branches and under loose bark. Their habits are unknown but warrant investigation as this insect or a relative is considered a pest in eastern Europe.

CICADAS (Family Cicadidae):

A black and orange species of cicada emerged in tremendous numbers in a pinon-juniper forest approximately 10 miles west of Walsenburg (Huerfano County). Oviposition on Rocky mountain juniper and Gambel oak (see Table) was reported. It is not known if tree roots were damaged by developing nymphs. The noise of "singing" adults could be considered a problem as the whole area is under residential development.

JUNIPER SPITTLE BUG (*Clastoptera* sp.):

Ornamental junipers along the Front Range frequently "grew" white spittle masses by the end of June, especially in 1978. Most homeowners correct this unsightly condition by regularly hosing down affected trees. Very little branch mortality or flagging was observed in either year.

SPRUCE SPIDER MITE (*Oligonychus ununguis*):

Spruce spider mite damage to Colorado blue spruce is a common late-summer occurrence, especially in the drier regions of Colorado west of the Continental Divide. 1978, the last of several dry years, was an exceptional year for mites on spruce state-wide.

Spruce spider mites were unusually common on Douglas-fir and ponderosa pine both years. In many cases, these high numbers could be linked to aerial applications of Sevin-4-Oil for western spruce budworm control and Sevimol-4 preventive sprayings for mountain pine beetle respectively. Not enough is known about "normal" mite levels to assign importance to these so-called build ups. Nevertheless, landowners and commercial applicators have been warned of this possible association. Areas involved are Estes Park, the Evergreen area, Colorado Springs, and Coal Creek Canyon (Boulder and Jefferson Counties).

Table 9. MISCELLANEOUS SOFTWOOD SUCKING INSECTS

Common Name	pinon pine	ponderosa pine	spruce	other pines	Comments/Location
giant conifer aphids		x			various species state-wide
pine needle scale	x	x	x	x	state-wide
pinon needle scale	x				Colorado Springs & Fort Garland

C.1 Table 10. BUD, SHOOT AND TWIG INSECTS -- HARDWOODS

Common Name	cottonwood	Gambel oak	willow	Comments/Location
a cicada		x		Gambel oak/ Black Forest
buffalo tree hopper	x		x	Poudre River east of Fort Collins
a gray tree hopper			x	Big Thompson Canyon
a mining sap feeder			x	Poudre River east of Fort Collins

C.2 Bud, Shoot and Twig Insects -- Softwoods

WHITE PINE WEEVIL (*Pissodes strobi*):

Continued mortality of Engelmann and Colorado blue spruce terminals occurred in Cuchara (Las Animas County). All size classes appear susceptible. Because some of these trees are maintained as ornamentals, control may be warranted. Other pockets of infested spruce were noted along the Dolores River between Rico and Lizard Head Pass (Dolores County), and along Route 24 near Florissant (Teller County).

Southwestern pine tip moth and others (*Rhyacionia neomexicana* and others including *zozana*, *bushnelli* & *fumosana*):

While an important, perennial problem on windbreak stock in the eastern plains, tip moths appear to be taking an added significance elsewhere. As Colorado's Front Range population continues to grow, new developments flourish. Landscaping in these neighborhoods often includes sapling to pole-size pines. Dieback and crooking were common on ponderosa, Scots, Austrian and Maglo pines in Fort Collins, Loveland, Longmont, Boulder and Denver.

Phenological Note: Southwestern pine tip moth adults emerging from root collar cocoons 4/9/69, CSFS Nursery west of Fort Collins. Emergence near complete by 4/24/79. Damage (and inquiries!) showed up in dramatic fashion about 7/9/79. Shoots inspected contained mature larvae.

PITCH-NODULE MOTHS (*Petrova metallica* & *P. arizonensis*):

Damage from these insects is usually minimal, but can be found throughout the ranges of ponderosa and pinon pine. Only on ornamentals are they a concern.

Phenological Note: 4/24/79, larvae and pupae collected on Austrian and ponderosa pine, CSFS Nursery, Fort Collins. Adult emergence in lab began 5/12/79. 5/28/79, adult moth seen on pine foliage, Horsetooth Reservoir (Larimer County).

Table 11. MISCELLANEOUS BUD, SHOOT AND TWIG INSECTS -- SOFTWOODS

Common Name	Juniper	lodgepole pine	pinon pine	ponderosa pine	Comments/Location
a cicada	x		x		
lodgepole terminal weevil		x			
other tip moths				x	
pine shoot moth		x			

D.1 Gall Insects and Mites -- Hardwoods

HACKBERRY NIPPLEGALL-MAKER (*Pachypsylla celtidismamma*):

This insect is common state-wide. With the increasing importance of hackberry as an ornamental, requests for control information are expected to continue.

A relative, the Hackberry petiolegall psyllid (*P. venusta*), was found on wild narrow-leaf hackberry near Kim (Baca County).

POPLAR GALL BORER (*Saperda* sp.):

Probably quite common but overlooked, branch damage was found in Loveland on cottonwood, and Fort Collins on willow and cottonwood. Damage directly attributable to these borers was not found elsewhere, but they may be an important member of pest complexes in declining trees.

ERIOPHYIID MITES (Family Eriophyiidae):

Ash flower gall mite (*E. fraxiniflora*) on green ash and poplar bud gall mite (*Aceria parapopuli*) on cottonwood were abundant state-wide at lower elevations. Other species caused gall-like distortion of (1) aspen shoots at Estes Park (Larimer County) and Apishapa Pass (Las Animas County), and (2) cottonwood catkins along the South Platte River at Sterling (Logan County).

MISCELLANEOUS HARDWOOD GALL INSECTS: (See Table 12, p. 42.)

Table 12. MISCELLANEOUS HARDWOOD GALL INSECTS

Common Name	aspen	cottonwood	honeylocust	maple	plum	willow	Comments/Location
poplar petiolegall aphid		x					state-wide, especially eastern plains
a narrow-leaf cottonwood psyllid		x					causing a leaf-curl gall/ Poudre Canyon
pine cone gall-maker						x	state-wide, especially stream side willow thickets
aspen twig gall fly	x						small branch galls/Larimer & Boulder Counties
a willow rosette gall midge						x	along Dolores River near Rico
honeylocust pod gall midge			x				state-wide on ornamentals
bean gall sawfly						x	Alamosa and near Rico
<i>Eura</i> gall sawfly						x	state-wide but local, willow thickets
purple erineum maple mite				x			mountain maple state-wide
a finger gall mite					x		ornamentals/Crestone

D.2 Gall Insects -- Softwoods

COOLEY SPRUCE GALL ADELGID (*Adelges cooleyi*):

Galls were common state-wide on Colorado blue and Engelmann spruce. Woolly nymphs occurred on Douglas-fir. Some cities are investigating the merits of spraying Douglas-fir inventories, which normally are much less than spruce inventories, in hopes of breaking the pests' alternate host cycle. In view of evidence that Douglas-fir is not an adelgid life cycle requirement, this strategy appears questionable.

Table 13. MISCELLANEOUS SOFTWOOD GALL INSECTS

Common Name	juniper	pinon pine	ponderosa pine	Comments/Location
needle gall midges (solid, stubby & spindle)		x		local, state-wide
pine bud gall midge			x	Black Forest
juniper berry gall midge	x			local, west slope

E.1 Inner-Bark Boring Insects -- Hardwoods

SMALLER EUROPEAN ELM BARK BEETLE (*Scolytus multistriatus*):

CSFS' Dutch elm disease control programs place primary importance on sanitation, or rapid elimination of dead and dying elm wood. The efficient role of this bark beetle in vectoring DED dictates high priority for sanitation of breeding sites.

Beetles have been found in 33 of Colorado's 63 counties. Counties added to this list in 1978 are Kiowa, Bent and Prowers Counties in southeast Colorado.

Pheromone-trapping continued for the fourth and fifth summers in Fort Collins. Dutch elm disease incidence apparently has not been altered significantly by trapping, despite impressive beetle catches. Pheromone traps will only be used as a survey tool to monitor beetle populations in selected areas (see also page 18).

ASH BARK BEETLES (*Leperisinus californicus*, *L. criddlei* & *L. aculeatus*):

All three species exist in Colorado but most detection reports specify only genus. Because their damage is similar, no further breakdown is probably needed.

Attacks are of two types: (1) branch-killing of otherwise healthy ash, and (2) branch and bole colorization of declining ash. Grand Junction, with its large numbers of borer-damaged green and European ash (see page 52), is a concentration area for ash bark beetles. Prominent among insects reared from dead Grand Junction ash was *L. californicus*.

Other collections and reports came from south of Loveland, Fort Collins, Canon City and Greeley(?). The aggressiveness reported by McKnight in North Dakota's *Lepersinus* population has not been observed in Colorado by CSFS.

Table 14. MISCELLANEOUS INNER-BARK-BORING INSECTS -- HARDWOODS

Common Name	aspen	elm	fruit trees	mtn. mahogany	hackberry	Comments/Location
red elm bark weevil		x				local in eastern Colorado
a hackberry engraver					x	in dead tree/Yuma
shot-hole borer			x			state-wide
an aspen bark beetle	x					ornamentals/La Veta
mtn. mahogany bark beetle				x		Dinosaur National Monument/ probably state-wide

E.2 Inner-Bark Boring Insects -- Softwoods

MOUNTAIN PINE BEETLE (*Dendroctonus ponderosae*):

Mountain pine beetle (MPB) remained at epidemic levels in 1978 and 1979, although there were signs of decline during the past year. This is still Colorado's most important forest insect problem, as it has been since the late 1960's.

The CSFS, USFS, National Park Service, Bureau of Land Management, city and county governments continue to cooperate with private citizens in controlling MPB.

Direct chemical control in Designated Control Areas (DCAs) makes up a large part of CSFS-Landowner efforts, but silvicultural preventive management is receiving increased emphasis. Progress toward intensive management has been real but slow. The celebrated Front Range Vegetative Management Pilot Project is an exception. Here with heavy government subsidy some 34,000 acres of mixed ownership were insulated against near-future beetle attack. MPB-caused tree mortality was cut by some 85% on the Project area, comparing 1979 with 1978. Vegetation Management is now in phase two in four Cooperative Management Demonstration Areas.

Figure 6 shows the current distribution of MPB. While beetle numbers in ponderosa pine have declined dramatically in Larimer and Boulder Counties, increases occurred in Las Animas and Huerfano Counties. Increases in lodgepole pine are suspected for Summit and Eagle Counties, although accurate figures are not available.

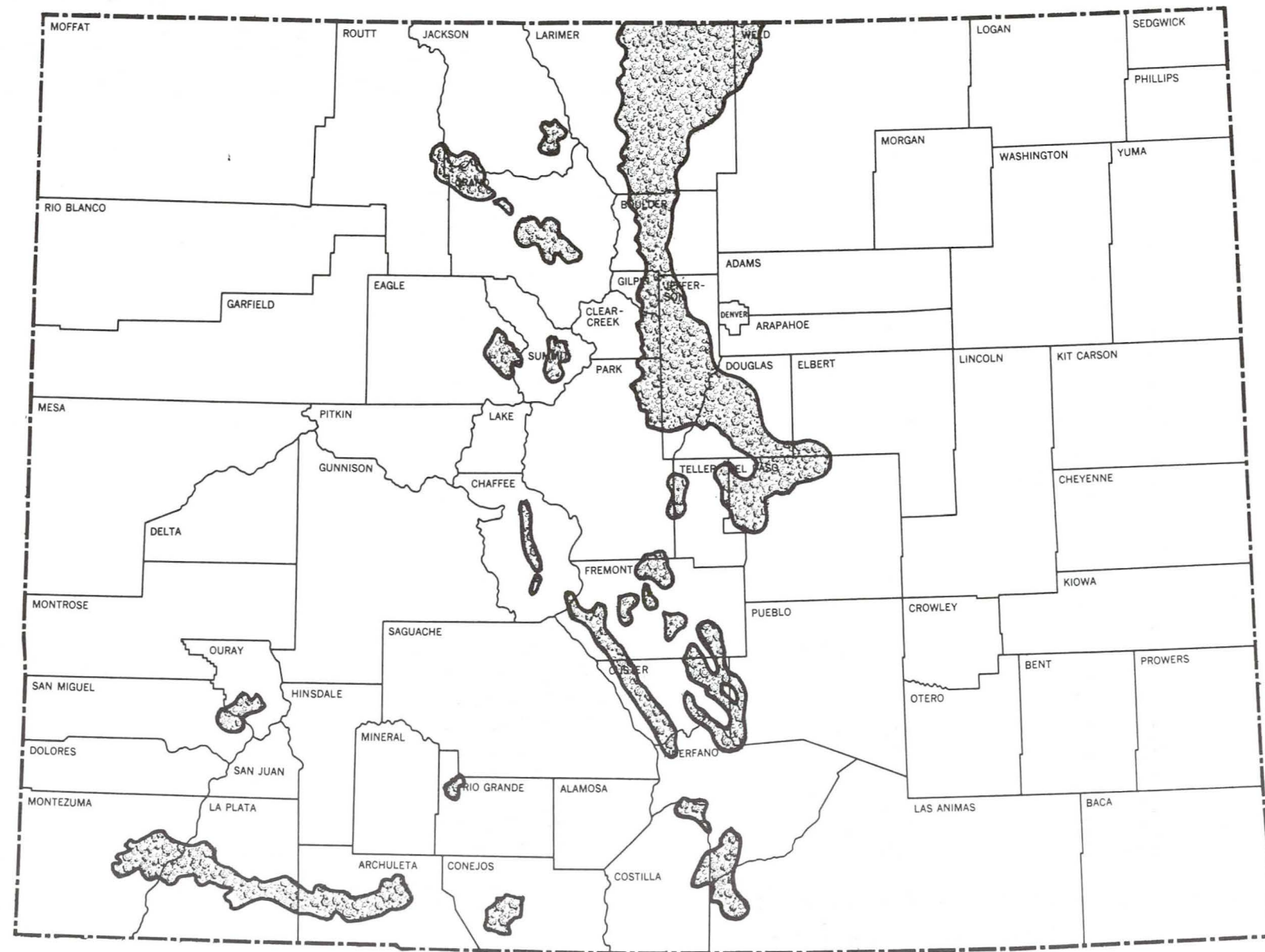
The following shows trends for local outbreaks outside or on the edge of Colorado's major Front Range infestation.

Area	Host Affected	Trend	CSFS District/County
Morrison Creek	P	static, low level	SS/Routt
Dillon	L	increasing	SS/Summit
Minturn-Redcliff	L	increasing(?)	SS/Eagle
Rabbit Ears Pass	P	static, low level	SS/Jackson
Weld County windbreaks	P	increasing(?)	FC/Weld
Allenspark	L	static, low level	BD/Boulder
Northeast Custer County	P	increasing	CC/Custer
Lake Otonawanda	P	static, moderate level	GJ/Ouray
Dallas Divide	P	static to decreasing	GJ/Ouray
Black Lake/Lake Lenore	P	static, low level	GJ/Ouray
Breen to Durango	P	increasing	DG/La Plata
Pagosa Springs	P	increasing(?)	DG/Archuleta
Mancos	P	static, low level	DG/Montezuma
Hermosa	P	static to increasing	DG/La Plata
Grand Lake	L	low level	SS/Grand

See Table 15 for DCA accomplishments in 1978 and 1979, and trends for MPB incidence.

General Distribution Of Mountain Pine Beetle (*Dendroctonus ponderosae*)
Colorado 1978 & 1979

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Scale of Miles
0 10 20 30 40 50

Figure 6.

Table 15. DCA ACCOMPLISHMENTS

District ^{1/}	County	DCA Name	1978		1979		% ^{2/} Reduction of Infested
			Total Infested	% Treated	Total Infested	% Treated	
Fort Collins	Larimer	Carter Lake	61	90.	3	100.	95
"	"	Crystal Lake	401	89.	85	91.	79
"	"	Estes Valley	2,800	91.	964	95.	66
"	"	Glacier View	-	-	342	96.	-
"	"	Harriman	420	91.	191	84.	54
"	"	Pinewood Lake	77	96.	51	94.	34
"	"	Pinewood Springs	370	83.	129	91.	65
"	"	Tahosa Valley	103	88.	-	-	-
Boulder	Boulder	Allenspark	5,931	72.	-	-	-
"	"	Blue Mountain	255	98.	114	89.	55
"	"	Boulder Heights	2,429	85.	2,455	86.	1 ^{3/}
"	"	Crestview/Lake Pines	225	88.	28	86.	88
"	"	Olde Stage	360	51.	528	84.	47 ^{3/}
"	"	Pinebrook Hills	951	91.	615	93.	35
"	"	St. Vrain	2,490	70.	846	56.	66
"	"	Sunbeam-Packer	-	-	2,503	75.	-
"	"	Sunshine	2,657	84.	818	86.	69
Golden	Jefferson	Blue Mountain II	1,115	85.	548	86.	49
"	"	Coal Creek	11,501	91.	2,011	59.	83
"	"	Conifer Meadow	3,388	89.	634	69.	81
"	"	Double-Aspen	2,856	97.	1,420	88.	50
"	Park	Elk Falls	166	97.	172	98.	4 ^{3/}
"	Jefferson & Clear Creek	Evergreen	60,465	95.	5,110	82.	75
"	Gilpin	Gilpin Lakes	511	92.	1,256	92.	145 ^{3/}
"	Jefferson	Indian Hills	5,063	99.	2,023	68.	60
"	"	Johns-Manville	-	-	-	-	-
"	"	Kings Valley	212	91.	80	85.	62
"	"	Mt. Vernon	30,985	90.	14,133	85.	54

(1) Arranged from north to south.

(2) $\frac{1978 \text{ infested} - 1979 \text{ infested}}{1978 \text{ infested}} \times 100$

(3) Increase.

Table 15, continued:

DCA ACCOMPLISHMENTS

District ^{1/}	County	DCA Name	1978		1979		% ^{2/} Reduction of Infested
			Total Infested	% Treated	Total Infested	% Treated	
Golden	Park	North Park County	4,886	92.	2,533	84.	48
"	Jefferson	Phillipsburg	4,506	97.	2,551	87.	43
"	"	South Turkey Creek	14,061	77.	7,288	48.	48
Denver	Douglas	Perry Park West	467	78.	588	89.	26 ^{3/}
Woodland Park	El Paso, Elbert & Douglas	Black Forest	42,290	64.	24,604	92.	42
"	El Paso	Ute Pass	4,546	84.	1,161	88.	75
"	Park	Wagon Tongue	1,480	87.	126	29.	92
"	El Paso	Woodman Valley	701	93.	16	69.	98
Canon City	Chaffee	Buena Vista	3,302	49.	3,082	88.	7
"	Fremont	Spruce Basin	541	78.	157	92.	71
LARK	Las Animas	Stonewall	-	-	1,108	84.	-
TOTALS			212,572	84.3	90,273	83.0	58

- 47a-
- (1) Arranged from north to south.
- (2) $\frac{1978 \text{ infested} - 1979 \text{ infested}}{1978 \text{ infested}} \times 100$
- (3) Increase.

Phenological Note: Peak emergence of MPB was generally late in 1979 with dates for Estes Park-Allenspark being

DOUGLAS-FIR BEETLE (*Dendroctonus pseudotsugae*):

Known areas of Douglas-fir beetle (DFB) infestation either remained static or declined. In general, DFB is at a low incidence level. The largest pocket of infestation detected was at Douglas Pass (Garfield County), where a three- to five-year-old outbreak continued (about 250 trees killed in 1978). Total number of dead-standing trees is estimated at 1000. Other minor locations:

Location	County	Comments
Estes Park	Larimer	scattered trees
South St. Vrain Canyon	Boulder	15-tree pocket
Trujillo Creek	Las Animas	30-45 trees
Chipita Park (not verified)	El Paso	scattered trees
Vallecito Reservoir	La Plata	100-150 trees
Buckhorn Creek	Larimer	small pockets
(Dolores Canyon	Montezuma	scattered, small pockets
north of Chimney Rock (20m))	Hinsdale	small pockets
west of Nathrop	Chaffee	one pocket of nine trees
south of Del Norte (15m)	Rio Grande	scattered individual trees
northwest of Capulin (12m)	Conejos	scattered, small pockets

SPRUCE BEETLE (*D. rufipennis*):

Endemic populations exist throughout the state. Rapid salvage of a mixed-conifer blowdown (May, 1977) on Muddy Pass (Jackson County) was largely accomplished in 1978 and potential spruce beetle host material eliminated.

ROUNDHEADED PINE BEETLE (*D. adjunctus*):

Occurred at relatively low levels in south-central and southwestern Colorado. Normally Roundheaded pine beetle (RHPB) shares large-diameter ponderosa pine with mountain pine beetle and other minor bark beetles. The trend state-wide appears to be static with no rapid spread. Suspected RHPB trees were detected in Custer, Pueblo and Chaffee Counties. The following are confirmed:

Location	County	Comments
Mancos (Camp Scotmar)	Montezuma	scattered
Pagosa Springs area	Archuleta	scattered
Cotopaxi area	Fremont	three trees
Stonewall area	Las Animas	scattered
Hermosa area	La Plata	scattered
north of Chromo	Archuleta	scattered
Vallecito Reservoir	La Plata	scattered

WESTERN PINE BEETLE (*Dendroctonus brevicornis*):

No confirmed cases recorded for 1978, but suspected Western pine beetle (WPB) were collected from the Mancos area (Montezuma County), near Lake Isabel (Pueblo County), and at Stonewall (Las Animas County) in 1979.

RED TURPENTINE BEETLE (*D. valens*):

This lower trunk-infesting beetle continued to confuse landowners during mountain pine beetle control operations. It also frequented thinnings and other areas of heavy cutting throughout Colorado. Fire areas, both wild and prescribed, were attractive to RTB, as were thinnings where burning of slash piles scorched residual trees. Known locations were:

Location	County	Comments
Flagstaff Mt.	Boulder	in stumps of thinned trees
Perry Park (west of)	Douglas	MPB-infested trees
Denver	Arapahoe	--
Black Forest	El Paso & Elbert	in thinned stand

FIR ENGRAVER (*Scolytus ventralis*):

Infestations of scattered trees or small groups occurred throughout the true fir type, particularly in the southern half of the state. Fir engraver was a common find during *Fomes annosus* detection surveys in Rio Grande, Conejos, Saguache, Custer, Pueblo, La Plata and Rio Blanco Counties. Perhaps the most significant case of fir engraver-associated mortality occurred in southern El Paso County along Route 115 where as many as 1000 trees in pockets of 15-20 were killed.

The expected increase of Fir engraver (FE) in the white fir needle miner area of Pass Spring Creek (Huerfano County) apparently did not take place. Tree mortality in that area is more directly attributed to repeated defoliation by the miner and Western spruce budworm (see page 28).

PINE ENGRAVER BEETLES (*Ips* spp. including *knausi*, *pini*, *calligraphus* & *confusus*):

In ponderosa pine engraver beetles commonly infest:

- (1) tops and limbs of MPB-killed trees,
- (2) residual trees scarred during harvest or salvage operations,
- (3) small-diameter trees on poor sites,
- (4) small-diameter trees on poor or moderate sites near harvest or salvage operations,
- (5) trees of all size classes weakened by residential or recreation activities,
- (6) lightning-struck, fire-damaged, and drought-weakened trees, and
- (7) other weak trees.

Reports in 1978 and 1979 follow this pattern with most coming from within mountain pine beetle-infested stands. Boulder, Jefferson, El Paso and Elbert Counties reported highest *Ips* incidences.

In lodgepole pine small, isolated pockets occurred near Allenspark (Boulder County), Evergreen (Jefferson County), Grand Lake (Grand County) and Frisco (Summit County).

Pinon forests in southern and western Colorado supported a few large infestations. These are thought to be linked to the dry years preceding 1978. *Ips confusus* was the pest responsible for mortality in most cases, and its abundance may have led to an overestimation of *Verticillium* root rot during aerial surveys. Mortality of several hundred trees was discovered south and west of New Castle including the East Divide Creek area (Garfield and Delta Counties). Lesser flare-ups occurred in the Red Mountain Road area (Garfield County) and on Pinon Mesa, west of Colorado National Monument (Mesa County).

Phenological Notes: *Ips* sp(p). Adults reported flying in Boulder County week of 4/16/79. 4/18/79, attacks by *Ips pini* on ponderosa pine transplanted in fall of 1978 detected. Gallery construction to date consisted of nuptial chambers and rarely egg galleries. CSFS Nursery, Fort Collins.

TWIG BEETLES (*Pityogenes* sp(p)., *Pityophthorus* sp(p)., & others):

Damage by twig beetles can be divided into two types: (1) twig, branch and upper bole attacks to mature, natural forest trees resulting in characteristic "flagging" of affected parts, and (2) branch and bole attacks to small transplants and other weakened ornamentals resulting in rapid mortality.

Examples of forest damage were common in 1978, uncommon in 1979. These levels appear related to tree-available moisture for the two years. Heavy flagging of note occurred at the rate of 10-15 bristlecone pines infested per acre throughout North Park (Park County) and west of Divide (Teller County).

Ornamental damage was common both years in the Fort Collins to Denver to Colorado Springs urban area where landscaping interest and planting is expanding.

Table 16. MISCELLANEOUS INNER-BARK-BORING INSECTS -- SOFTWOODS

Common Name	true firs	Douglas-fir	ponderosa pine	Comments/Location
western balsam bark beetle	x			Cuchara, Telluride(?), etc.
Douglas-fir pole beetle		x		pole-size trees/Jarre Canyon
hylurgops beetles			x	state-wide in MPB-trees

F.1 Wood Borers -- Hardwood

CARPENTERWORM (*Prionoxystus robiniae*):

Since 1978, improved detection efforts by CSFS have shown this aggressive borer to be abundant in eastern Colorado. Siberian elm, particularly in windbreaks, is the predominant host. Attacks are commonly confined to the lower trunk, but have been noted at heights up to 15'.

Detection records from Sedgwick, Yuma, Logan, Morgan, Phillips, Larimer, Cheyenne, Kit Carson, Otero and Mesa Counties indicate carpenterworm probably exists state-wide at lower elevations. The Mesa County record was from globe willow, all others from Siberian or American elm. Green ash, an uncommon species in Colorado windbreaks, is known to be a common host elsewhere in the Great Plains. *Fomes fraxinophilus* surveys to be performed in 1980 will include checks for carpenterworm.

In 1979, a pheromone study to initially determine the adult male emergence period in Colorado was conducted in cooperation with the RMFRES Shelterbelt Lab (Bottineau, North Dakota) personnel. Traps were placed in four field locations 5/25 and 5/31/79, and at three other locations on various later dates. Table 17 summarizes trap catches that indicate that in eastern Colorado male moth emergence peaked between mid-June and early-July. Emergence probably begins as early as late-May and continues into early-August.

Future studies will determine trap efficiency, refine emergence period information and hopefully lead to registration of control-trapping techniques. Reduction of carpenterworm impact in shelterbelts is the ultimate goal.

LILAC BORER (*Podosesia syringae*):

This moth is a common borer of both ornamental ash and lilac. In fall 1979, a particularly damaging population was found in Grand Junction's street trees. Of the 823 European ash (*F. quadrangulata*) examined, 686 (83%) were heavily infested by lilac borer. An unknown number had died and been removed before the survey. Some particularly valuable trees will be sprayed in early summer 1980 to prevent further attacks. The application will be timed to coincide with peak adult emergence as determined by pheromone trap monitoring.

Table 17. SUMMARY OF CARPENTERWORM
 PHEROMONE-TRAP CATCHES 1979,
 EASTERN COLORADO WINDBREAKS

Approx. Trap Location	Type *	Date Initiated	Trap Count Dates				
			6/1-5	6/15	7/3	7/17	8/10
Holyoke	A	5/25	11	44	28	6	2
Laird	B	5/25	1	17	4	4	0
Sterling	B	5/31	-	71	49	1	2
Fort Morgan	A	5/31	15	-	32	2	0
Yuma	B	6/5	<u>1</u>	<u>4</u>	<u>25</u>	<u>7</u>	<u>5</u>
			29	136	138	20	9

* A = Dispenser contained 500 micrograms Z, E3, 5 Tetradecadien-1-ol acetate (TDDA).

B = Dispenser contained 106 micrograms TDDA.

Other traps were maintained for parts of the above trapping season at Fort Collins and Flagler (Kit Carson County). Both traps caught male moths.

Other lilac borer reports in ash came from north of Holyoke (Sedgwick County), Fort Collins and Greeley. Lilac infestations were common on the CSU Campus in Fort Collins.

POPLAR BORER (*Saperda calcarata*):

Most aspen stands examined were found to have some poplar borer. It appears to be fairly aggressive and locally damaging. Particularly hard hit stands were noted in the Meeker Park-Wild Basin area (Boulder County), north of Riverside (Boulder County) and north of Chromo (Archuleta County).

BANDED ASH BORER (*Neoclytus caprea*):

In Grand Junction, this secondary borer regularly colonized the trunk and branches of weakened European ash. As many as 37 larval tunnels were discovered in a cross-section of trunk, 4" in diameter. Homeowners in Grand Junction often blame tree death or deformity on this insect rather than the true cause, lilac borer.

HONEYLOCUST FLATHEADED BORER (*Agrilus difficilis*):

Honeylocust samples sent to the CSFS Insect and Disease Laboratory for confirmation of *Thyronectria* canker frequently contain specimens or evidence of a purplish borer. It is possible *A. difficilis* vectors the causal fungus.

FLATHEADED APPLE TREE BORER (*Chrysobothris femorata*):

Reported by Dutch elm disease project personnel to be a common source of branch damage to American elm throughout La Junta (Otero County).

WILLOW AND POPLAR BORER (*Cryptorhynchus lafathi*):

Because its usual Colorado habitat, willow thickets, is of relative low value, this stem-boring weevil is often overlooked. Ornamental willow clumps near the CSU Lagoon, Fort Collins, were severely killed-back by repeated basal boring. One patch has been culled completely by groundskeepers and replacement plantings will be necessary.

Table 18. MISCELLANEOUS HARDWOOD WOOD BORERS

Common Name	ash	aspen	black locust	elm	maple	white poplar	willow	Comments/Location
a willow clearwing borer							x	
a white poplar clearwing borer						x		
aspen ambrosia beetle		x						
elm borer				x				
locust borer			x					
small banded ash borer	x							
redheaded ash borer	x							
an aspen <i>Agrilus</i> (sp. or spp.)		x						
pole borer (<i>Parandra</i>)				x	x			

Phenological Note: Adult weevils emerging, CSU, .
8/18/79, and Big Thompson Canyon
(Larimer County), 8/3/79.

F.2 Wood Borers -- Softwood

PINE LONGHORNED BORERS (*Cerambycidae*):

Among the more common genera recorded, particularly in mountain pine beetle-killed trees, were *Stenocorus*, *Monochamus*, *Canonura* (*Acanthocinus*), and *Ergates*. Certain species are suspected of contributing to local mountain pine beetle (MPB) population declines. This is being documented by Rocky Mountain Forest and Range Experiment Station (RMFRES) personnel.

PINE METALLIC WOOD BORERS (*Buprestidae*):

Like the cerambycids, these conspicuous insects generate much unnecessary concern among homeowners. The genera *Buprestis*, *Dicerca*, *Chalcophora*, *Melanophila* and *Chrysobothris* are common along the Front Range, especially in all MPB-infested ponderosa pine.

PITCH-MASS BORER (*Vespanima* sp.):

Larvae of a clearwing moth were found boring in Engelmann spruce branch and stem cankers caused by *Cytospora* (*Valsa*) *kunzei*. Several mature ornamentals in the Broadmoor-Cheyenne Mountain Section of Colorado Springs were reported.

PINON PITCH BORER (*Dioryctria* sp. near *albovitella*):

A major cause of homeowner concern in the Denver area for years, little definite information on the stem-boring moths' life cycle was available prior to 1978. CSU researchers plan to publish recent findings, perhaps making prevention more feasible than the normal post-attack control attempts have been.

Infestations of this or related species of *Dioryctria* are known to be in Owl Canyon (Larimer County), west of Walsenburg (Huerfano County), Royal Gorge (Fremont County), Colorado National Monument (Mesa County) and Mesa Verde National Park (Montezuma County). In most areas shoot damage is more common than trunk attacks. Some researchers suspect the shoot and trunk attacks are made by separate species.

PINE HORNTAIL (*Xeris spectrum*):

Several individuals were observed in July, 1979 ovipositing in a mature MPB-infested ponderosa pine at Estes Park (Larimer County). This same tree had been treated with cacodylic acid the previous September.

G.1 Seed Insects -- Hardwoods

BOXELDER BUG (*Leptocoris trivittatus*):

Boxelder bug was again common state-wide both as a feeder on boxelder seeds and a nuisance pest around homes. Particularly high populations existed on the LARK (1978) and Durango (1979) Districts.

SEED BEETLE (*Bruchidae*):

Members of this curious group are probably distributed state-wide wherever honeylocust has been planted. Extensive seed pod feeding was observed near Bonny Reservoir (Yuma County) and in Grand Junction.

G.2 Cone and Seed Insects -- Softwoods

Currently cone and seed insects in Colorado command little attention, except from a modest research effort. As more emphasis is given tree improvement programs, identity and impact assessment of these insects will increase in importance.

Random CSFS detection reports over the past two years include: *Conophthorus* cone beetles in ponderosa pine in Sugarloaf area (Boulder County); *Conophthorus* cone beetles in both ponderosa and pinon pine at Great Sand Dunes National Monument (Saguache County); western spruce budworm in Douglas-fir cones in Poudre Canyon (Larimer County) and west of Larkspur (Douglas County); *Dioryctria* cone moths and a *Leptoglossus* leaf-footed bug in ponderosa pine throughout the Front Range. Future detection efforts should be directed toward these pests.

H. Root Insects -- Hardwoods and Softwoods

Little is known about root insects and their impact in Colorado. Both white grubs (Scarabaeidae) and cicadas (see page 38) are suspected of contributing to tree decline, especially in Colorado tree nurseries.

I. Animal Damage

The particularly harsh winters of '77-'78 and '78-'79 apparently contributed to increased feeding on tree bark and shoots by rodents. Bark stripping of small branches was quite evident in many localities on a variety of hosts. In addition to porcupines, the Aberts squirrel, Golden-mantled ground squirrel and fox squirrel are thought to be the most damaging rodents in this respect. Specific examples of locally-heavy damage were: ponderosa pines between Durango and Mancos along Route 550 and near Lake George (Park County); lodgepole pines in Nederland (Boulder County); and elms in La Junta (Otero County).

Yellow-bellied sapsuckers (*Sphyrapicus varius*) did an uncommonly heavy amount of damage to off-site Scots pine ornamentals at the Stony Knob Motel in Estes Park. Excessive branch flagging and death could be directly tied to repeated

trunk wounding by the birds. Some trees were being hit by turpentine beetles.

Normal losses from gophers, deer, rabbits and mice in new plantings occurred state-wide.

A P P E N D I X I

Insect & Disease Occurrence By County

(* indicates 1979 observation)

The following pests are so widely distributed throughout their respective host ranges that specific location references are limited to special cases or omitted completely.

Insects

a willow leaf beetle
boxelder bug
Cooley spruce gall adelgid
cottonwood blotch miner
cottonwood leaf beetle
elm leaf beetle
engraver (*Ips*) beetles
European elm scale
fall webworm
forest tent caterpillar
fruit-tree leaf roller
linden looper
oystershell scale
pine flatheaded borers
pine roundheaded borers
poplar leaf-folding sawfly
red turpentine beetle
spiny elm caterpillar
tip moths
twig beetles
woolly elm aphid
American dagger moth
ash flowergall
euura gall sawfly
pine needle scale
giant conifer aphid
juniper spittlebug
cicadas
a pine flat bug
chafers
two spotted spider mite
short horned grasshopper
hackberry butterfly
lilac leaf miner
a canker worm
uniform caterpillar

Diseases

bacterial gall of Douglas-fir
cytospora canker
fireblight
slime flux
Dutch elm disease
dwarf mistletoes

Insects

poplar petiolegall aphid
pear slug
ugly-nest caterpillar
sonoran tent caterpillar
green fruit worm
cecropia moth
western tiger swallowtail
polyphemus moth
aspen leaf miner
woolly apple aphid
European fruit lecanium
ants
southwestern pine tip moth
pine cone gall-maker
pine budworm
spruce needle miner
weevils
purple erineum maple mite
cottony maple scale
spruce spider mite
pitch nodule moth
lodgepole terminal weevil
pine shoot moth
hackberry nipple gall-maker
poplar bud gall mite
honeylocust pod gall midge
shot-hole borer
mtn. mahogany bark beetle
mountain pine beetle
carpenterworm
elm borer
locust borer
redheaded ash borer
pole borer
an aspen *Agrilus* (sp. or spp.)
pine longhorned borers
pine metallic wood borers
Dioryctria cone moth
Leptoglossus leaf-footed bug
white grub

ADAMS COUNTY

elm leaf beetle
lesser European elm bark beetle
pine tip moth

Diseases

Dutch elm disease*
thyronectria canker
cytospora canker
slime flux
Anthracnose

Insects

Diseases

ALAMOSA COUNTY

lesser European elm bark beetle
western spruce budworm
woolly aphids*
apple leaf aphid*
spider mites
tiger swallowtail
brown apricot scale
chokecherry leaf aphid
fruit tree leaf roller
pine needle scale
poplar leaf-petiolegall aphid
chokecherry aphid
willow pod-gall aphid
cottonwood blotch miner
bean gall sawfly

cytospora canker*
Douglas-fir dwarf mistletoe
fireblight*
a pinyon needlecast
juniper broom rust
juniper gall rust
gummosis of Russian olive
elytroderma needle cast

ARAPAHOE COUNTY

red turpentine beetle
lesser European elm bark beetle

Dutch elm disease
thyronectria canker
slime flux
cytospora canker

ARCHULETA COUNTY

forest tent caterpillar
mountain pine beetle*
roundheaded pine beetle*
sonoran tent caterpillar
western tent caterpillar*
poplar borer
oak lacebug
engraver beetle

Douglas-fir dwarf mistletoe
juniper true mistletoe
southwestern dwarf mistletoe
armillaria root rot
fir rust broom
annosus root rot
ink spot
poplar leaf spot
fir witches' broom
cryptosphaeria canker
cenangium canker
ceratocystis canker
cytospora canker
cryptochaete decay
false tinder fungus
marsonnina leaf spot
juniper gall rust

BACA COUNTY

hackberry petiolegall psyllid
lesser European elm bark beetle

Insects

BENT COUNTY

juniper leaf miner
European elm scale
lesser European elm bark beetle
pinyon pitch borer

BOULDER COUNTY

a flatheaded wood borer
 (honeylocust)
a spruce tussock moth
cottonwood leaf beetle
cottony maple scale
Douglas-fir tussock moth
Ips spp.*
lesser European elm bark beetle
mountain pine beetle*
pine budgall midge
pine cone worm
pine butterfly
pine tip moth
pine budworm
oak kermes scale
pine tiger moth*
pine webworm or near relative
ponderosa needle miner*
poplar borer*
spider mites
southwestern pine tip moth
western spruce budworm*
twig beetle*
western tent caterpillar
woolly aphids*
poplar gall mite
Douglas-fir weevils
pine cone moth
bull pine sawfly
aspen twig gallfly
red turpentine beetle
Conophthorus cone beetle
Douglas-fir beetle

CHAFFEE COUNTY

roundheaded pine beetle
a pine sawfly
fall webworm*
Ips spp.
mountain pine beetle
twig beetle
poplar midge galls
Douglas-fir beetle

Diseases

cytospora canker
poplar leaf blight
Dutch elm disease
fireblight
thyronectria canker

cottonwood leaf spot
cytospora canker
Dutch elm disease*
limber pine dwarf mistletoe
lodgepole pine dwarf mistletoe
mahonia rust
southwestern dwarf mistletoe
thyronectria canker
poplar wetwood
western gall rust
an aspen leaf spot
ink spot
juniper gall rust

Douglas-fir dwarf mistletoe
lodgepole pine dwarf mistletoe
shoestring root rot
southwestern dwarf mistletoe
poplar wetwood

Insects

Diseases

CHEYENNE COUNTY

lesser European elm bark beetle

Dutch elm disease*

CLEAR CREEK COUNTY

a spruce tussock moth
Douglas-fir tussock moth
mountain pine beetle
western spruce budworm

limber pine dwarf mistletoe
lodgepole pine dwarf mistletoe
southwestern dwarf mistletoe

CONEJOS COUNTY

mountain pine beetle
pitch nodule moths
western tent caterpillar
fir engraver
Douglas-fir bark beetle

Douglas-fir dwarf mistletoe*
southwestern dwarf mistletoe*
armillaria root rot
annosus root rot

COSTILLA COUNTY

pinyon needle scale
white fir needle miner
western spruce budworm*

southwestern dwarf mistletoe
juniper broom rust
cytospora canker
cenangium canker
ceratocystis canker
cryptosphaeria canker
a white fir needle cast

CROWLEY COUNTY

lesser European elm bark beetle

Dutch elm disease*

CUSTER COUNTY

fir engraver
mountain pine beetle
western spruce budworm*
roundheaded pine beetle*
agrilus borer

Douglas-fir dwarf mistletoe
southwestern dwarf mistletoe
spruce witches' broom
fir witches' broom
spruce rust broom
armillaria root rot
brown crumbly rot
Douglas-fir bacterial gall
false tinder fungus
fir rust broom
Indian paint fungus
annosus root rot

DELTA COUNTY

Douglas-fir beetle
fall webworm
pine tiger moth
Ips spp.

juniper true mistletoe
pinyon pine dwarf mistletoe
cytospora canker

Insects

DENVER COUNTY

a flatheaded wood borer
 (honeylocust)
Douglas-fir tussock moth*
European elm scale
forest tent caterpillar
hackberry nipple gall
lesser European elm bark beetle
lilac/ash borer
pitch nodule moths
putnam scale
elm leaf beetle
giant willow aphid

DOLORES COUNTY

fir bark beetle
white pine weevil
a willow rosette gall midge
bean gall sawfly

DOUGLAS COUNTY

bull pine sawfly
a spruce tussock moth
Douglas-fir tussock moth
lesser European elm bark beetle
mountain pine beetle
pine budworm
ponderosa needle miner
ugly-nest caterpillar
western spruce budworm
white fir needle miner
nematodes
pine cone worm
lilac leaf miner
lace bug
red turpentine beetle
Conophthorus cone beetle

EAGLE COUNTY

Diseases

Dutch elm disease
fireblight
southwestern dwarf mistletoe
thyronectria canker
cytospora canker
slime flux

Douglas-fir dwarf mistletoe
juniper true mistletoe
leaf blister of oak
pinyon pine dwarf mistletoe
southwestern dwarf mistletoe

Douglas-fir dwarf mistletoe
Dutch elm disease*
lodgepole pine dwarf mistletoe
southwestern dwarf mistletoe
poplar wetwood
hail damage

Douglas-fir dwarf mistletoe
lodgepole pine dwarf mistletoe
ink spot

Insects

ELBERT COUNTY

a cicada
a pine sawfly
Ips spp.
lesser European elm bark beetle
mountain pine beetle*
pine butterfly*
pine tiger moth
pitch nodule moths
ponderosa needle miner
twig beetle
red turpentine beetle

EL PASO COUNTY

a pine sawfly
Douglas-fir tussock moth*
lesser European elm bark beetle
mountain pine beetle
pandora moth or near relative
pine budworm
pine butterfly
ponderosa needle miner
western spruce budworm
bull pine sawfly
pinyon needle scale
red turpentine beetle
fir engraver
pine horntail
pitch mass borer
spider mites
pitch midge
boxelder leaf roller
green fruit worm
linden looper
eriophyiid mites
spruce webspinning sawfly
sonoran tent caterpillar

FREMONT COUNTY

elfin butterfly
a juniper leaf miner
lesser European elm bark beetle
mountain pine beetle
pine tiger moth
western spruce budworm
juniper spittlebug*

Diseases

Dutch elm disease
southwestern dwarf mistletoe
tubercularia canker

Douglas-fir dwarf mistletoe
Dutch elm disease*
limber pine dwarf mistletoe
southwestern dwarf mistletoe
nectria canker
spruce cytospora canker
shoestring root rot

catalpa leaf spot
Douglas-fir dwarf mistletoe*
Dutch elm disease*
fireblight*
limber pine dwarf mistletoe
shoestring root rot
southwestern dwarf mistletoe

Insects

FREMONT COUNTY (cont.)

spider mites*
carpenterworm*
walnut aphid
pine needle scale
roundheaded pine beetle
fall webworm
ash bark beetle
pinyon pitch borer

GARFIELD COUNTY

Ips spp.
Douglas-fir beetle
flocculent fir aphid
pinyon engraver
spider mites

GILPIN COUNTY

a spruce tussock moth
Douglas-fir tussock moth
mountain pine beetle
western spruce budworm

GRAND COUNTY

mountain pine beetle*
Ips spp.
poplar leaf-petiolegall mite
cottonwood blotch miner

GUNNISON COUNTY

western spruce budworm
cottonwood blotch miner

Diseases

thyronectria canker
powdery mildew*
juniper pocket rot*
poplar wetwood
gummosis of Russian olive

Douglas-fir dwarf mistletoe
juniper true mistletoe
pinyon pine dwarf mistletoe
spruce witches' broom
juniper gall rust
cytospora canker
cenangium canker
ceratocystis canker
cryptosphaeria canker

limber pine dwarf mistletoe
lodgepole pine dwarf mistletoe
southwestern dwarf mistletoe

spruce witches' broom
fir witches' broom
winter drying
lodgepole pine dwarf mistletoe*
comandra rust
armillaria root rot
western gall rust
fir rust broom
spruce rust broom
poplar wetwood

cenangium canker
cytospora canker
ceratocystis canker
cryptosphaeria canker
Douglas-fir dwarf mistletoe
lodgepole pine dwarf mistletoe

Insects

HINSDALE COUNTY

Douglas-fir bark beetle

HUERFANO COUNTY

alder sawfly
alder spittlebug
fall webworm
fir engraver
mountain pine beetle
pitch nodule moths
spruce beetle
western spruce budworm
western tent caterpillar*
white fir needle miner
birch blotch leaf miner
birch maple gall mite
bronze birch borer
white fir needle miner
ambrosia beetle
an aspen bark beetle
aspen ambrosia beetle
pinyon pitch borer

JACKSON COUNTY

mountain pine beetle
spruce beetle
pandora moth

Diseases

Douglas-fir dwarf mistletoe*
southwestern dwarf mistletoe
ink spot
shepherds crook
armillaria root rot
pollacia blight
annosus root rot

cottonwood leaf spot
Douglas-fir dwarf mistletoe
limber pine dwarf mistletoe
shoestring root rot
southwestern dwarf mistletoe
annosus root rot
birch die back
a white fir needle cast
shepherds crook
spruce witches' broom
thyronectria canker
cytospora canker
spruce pocket rot
armillaria root rot
Indian paint fungus
pollacia blight
artists conk
nectria canker

limber pine dwarf mistletoe
lodgepole pine dwarf mistletoe
ceratocystis canker
cenangium canker
comandra rust
spruce witches' broom
fir witches' broom
western gall rust
spruce rust broom
fir rust broom
armillaria root rot
brown crumbly rot

Insects

JEFFERSON COUNTY

aphids
a spruce tussock moth
Douglas-fir tussock moth
elm leaf beetle
Ips spp.
lesser European elm bark beetle
lodgepole terminal weevil
mountain pine beetle
pigeon tremex
pine budworm*
pine moth
ponderosa needle miner
poplar borer
spider mites
western spruce budworm*

KIOWA COUNTY

lesser European elm bark beetle
elm leaf beetle

KIT CARSON COUNTY

lesser European elm bark beetle

LAKE COUNTY

LA PLATA COUNTY

lesser European elm bark beetle
mountain pine beetle*
pinyon needle miner
ponderosa needle miner*
red turpentine beetle
sonoran tent caterpillar
twig beetle*
western spruce budworm*
oyster shell scale
Ips spp.
a white poplar clearwing borer
oak leafroller
clearwing moth
purple maple mite
Douglas-fir pole beetle
Douglas-fir bark beetle
fir engraver

Diseases

Douglas-fir dwarf mistletoe (?)
Dutch elm disease
lodgepole pine dwarf mistletoe
southwestern dwarf mistletoe
gummosis of Russian olive
poplar wetwood

Dutch elm disease*
tubercularia canker

lodgepole pine dwarf mistletoe

spruce witches' broom
Douglas-fir dwarf mistletoe
drought stress
juniper true mistletoe*
pinyon pine dwarf mistletoe
southwestern dwarf mistletoe
annosus root rot
Douglas-fir bacterial gall
oak blister fungus
Indian paint fungus
fir witches' broom
pouch fungus
ceratocystis canker
false tinder fungus
brown crumbly rot
blue stain (pinyon)
spruce rust broom

Insects

LA PLATA COUNTY (cont.)

willow stem gall sawfly
alder spittlebug
birch maple gall mite
birch blotch leaf miner
birch sawfly
roundheaded pine beetle
a tortricid leaf roller complex
Glover's silk moth
unicorn caterpillar
yellow and black halisidota
pine tiger moth
bull pine sawfly
cottony maple scale
Douglas-fir beetle

LARIMER COUNTY

American dagger moth*
a pine sawfly
a ponderosa pine cone weevil
ash bark beetle*
a spruce tussock moth
black hills pandora moth
lilac/ash borer
cottony maple scale*
Douglas-fir bark beetle*
European elm scale
false pine looper
forest tent caterpillar*
green fruitworm
Hylurgops spp.
Ips spp.
lesser European elm bark beetle
lodgepole terminal weevil
mountain pine beetle*
pandora moth or near relative
pigeon tremex
pine budworm
pine butterfly*
pine horntail
pine tiger moth
pine tip moth
pine tussock moth
pine webworm or near relative
pitch nodule moths*
ponderosa needle miner*
poplar leaf beetle

Diseases

fir rust broom
thyronectria canker
cryptosphaeria canker
cenangium canker
cytospora canker
black stain root disease

aspen leaf spot
Dutch elm disease*
fireblight
limber pine dwarf mistletoe
lodgepole pine dwarf mistletoe
southwestern dwarf mistletoe
thyronectria canker*
tubercularia canker
comandra rust
western gall rust
armillaria root rot
juniper broom rust
ceratocystis canker
cenangium canker
hypoxylon canker
cytospora canker
a lodgepole needle cast
poplar leaf spot
spruce witches' broom
fir witches' broom
juniper gall rust
cryptosphaeria canker
slime flux
camarosporium canker
melanconium canker
gummosis of Russian olive

Insects

Diseases

LARIMER COUNTY (cont.)

poplar tent-maker
ponderosa needle miner
strawberry root weevil
twig beetle*
ugly-nest caterpillar
western pine engraver
western tent caterpillar
western pine shoot borer
western spruce budworm*
white pine weevil
willow weevil
alder spittlebug
broad-nosed weevil
poplar gall borer
eriophyiid mites
cottonwood leaf beetle
buffalo tree hopper
spider mites
poplar borer
cecropia moth
io moth
red humped caterpillar
Wiedemeyer's admiral butterfly
willow leaf beetle
yellow buck moth
tiger moth
clearwing moth borer
willow-poplar borer
fir cone worm
a pine sawfly complex
spiny elm caterpillar
fall webworm
a tortricid leaf roller complex
viceroy butterfly
Glover's silk moth
giant willow aphid
solitary web-spinning sawfly
gray pine false looper
elfin butterfly
elm spanworm
ash plant bug
poplar tent-maker
a gray tree hopper
a mining sap feeder
aspen twig gall sawfly
a narrow leaf cottonwood psyllid
a willow clearwing borer
pinyon pitch borer
Conophthorus cone beetle

Insects

LAS ANIMAS COUNTY

a pine tiger moth
a pine horntail
a tachinid fly
Douglas-fir beetle
fall webworm
fir engraver
alder spittlebug
eriophyiid mites
western pine beetle
bull pine sawfly
Ips spp.
lesser European elm bark beetle
mountain pine beetle
red turpentine beetle
roundheaded pine beetle*
spruce beetle
western spruce budworm
western tent caterpillar*
white fir needle miner
white pine weevil

LINCOLN COUNTY

lesser European elm bark beetle
a pine sawfly complex

LOGAN COUNTY

ants
eriophyiid mites
fall webworm
lesser European elm bark beetle
poplar leaf rollers
(miscellaneous)
western spruce budworm
Zimmerman pine moth
cottonwood leaf beetle
cottonwood twig borer
carpenterworm
fall cankerworm
a spine sawfly complex

MESA COUNTY

a katydid
a juniper flatheaded borer
ash bark beetle
a walnut aphid

Diseases

Douglas-fir dwarf mistletoe*
Dutch elm disease
southwestern dwarf mistletoe*
thyronectria canker
a white fir needle cast
pouch fungus
juniper gall rust
ceratocystis canker
cenangium canker
cytospora canker
cryptosphaena canker
sphaeria root rot

Dutch elm disease*
tubercularia canker

Dutch elm disease*
cytospora canker
tubercularia canker
elm slime flux

aspen leaf spot
cottonwood leaf spot
Douglas-fir dwarf mistletoe
Dutch elm disease

Insects

Diseases

MESA COUNTY (cont.)

Douglas-fir beetle
elm leaf beetle
Ips spp.
lesser European elm bark beetle
honeylocust seed beetle
pine aphid
lilac/ash borer
twig borer
ash woolly aphid
seed beetle
elm leaf beetle
forest tent caterpillar
flatheaded borers
European elm scale
spider mites
fall webworm
pine needle scale
pigeon tremex
carpenter worm
small banded ash borer
ash plant bug
banded ash borer

juniper true mistletoe
pinyon pine dwarf mistletoe
southwestern dwarf mistletoe
willow wetwood
thyronectria canker
cytospora canker
powdery mildew
elm slime flux
salt damage

MINERAL COUNTY

Douglas-fir dwarf mistletoe
southwestern dwarf mistletoe

MOFFAT COUNTY

pine tiger moth

cenangium canker
cryptosphaeria canker
juniper gall rust
ceratocystis canker
cytospora canker
lodgepole pine dwarf mistletoe

MONTEZUMA COUNTY

elm leaf beetle
lesser European elm leaf beetle
mountain pine beetle
red turpentine beetle
roundheaded pine beetle
Douglas-fir bark beetle
willow pod gall aphid
willow stem gall
white pine weevil
western pine beetle
pinyon pitch borer

Douglas-fir dwarf mistletoe
juniper true mistletoe
pinyon pine dwarf mistletoe
southwestern dwarf mistletoe
black stain root disease

Insects

Diseases

MONTROSE COUNTY

lesser European elm bark beetle*
western tent caterpillar

aspen ink spot
Douglas-fir dwarf mistletoe
juniper true mistletoe
pinyon pine dwarf mistletoe
southwestern dwarf mistletoe

MORGAN COUNTY

ants
lesser European elm bark beetle
ash-gray blister beetle
cottonwood leaf beetle

cottonwood leaf spot
Dutch elm disease*
anthracnose
cytospora canker
poplar wetwood

OTERO COUNTY

carpenterworm
elm leaf beetle
fall webworm*
lesser European elm bark beetle
flatheaded apple tree borer

drought stress
juniper gall rust
Dutch elm disease*
thyronectria canker*
cytospora canker

OURAY COUNTY

fir engraver
mountain pine beetle*

Douglas-fir dwarf mistletoe
pinyon dwarf mistletoe
southwestern dwarf mistletoe

PARK COUNTY

mountain pine beetle
pine budworm
ponderosa needle miner
western spruce budworm
western tent caterpillar
twig beetles

Douglas-fir dwarf mistletoe
lodgepole pine dwarf mistletoe
southwestern dwarf mistletoe*
spruce witches' broom

PHILLIPS COUNTY

carpenterworm
juniper webworm
elm leaf beetle
lesser European elm bark beetle
pine tip moths
Zimmerman pine moth*
a pine sawfly complex

Dutch elm disease*
elm slime flux
thyronectria canker
tubercularia canker

Insects

PITKIN COUNTY

white pine weevil
mountain pine beetle*

PROWERS COUNTY

lesser European elm bark beetle

PUEBLO COUNTY

western pine beetle
lesser European elm bark beetle*
mountain pine beetle*
fir engraver
sonoran tent caterpillar
juniper spittlebug
western spruce budworm
a pine sawfly complex
roundheaded pine beetle

RIO BLANCO COUNTY

horntail
fir engraver
pinyon needle miner

RIO GRANDE COUNTY

mountain pine beetle*
Douglas-fir bark beetle*
fir engraver

ROUTT COUNTY

poplar borer
ugly-nest caterpillar
spider mites
cottonwood blotch miner
western tent caterpillar
giant willow aphid

Diseases

cottonwood leaf spot
Douglas-fir dwarf mistletoe
lodgepole pine dwarf mistletoe

Dutch elm disease
cytospora canker

Douglas-fir dwarf mistletoe*
Dutch elm disease*
southwestern dwarf mistletoe*
annosus root rot
hypoxylon canker
artist's conk
armillaria root rot
tubercularia canker
pouch fungus

gummosis of Russian olive
fireblight
lodgepole pine dwarf mistletoe
pinyon pine dwarf mistletoe
willow wetwood
venturia blight of cottonwood

Douglas-fir dwarf mistletoe*
southwestern dwarf mistletoe
juniper gall rust
annosus root rot

drought stress
lodgepole pine dwarf mistletoe
cenangium canker
ceratocystis canker
spruce witches' broom
an aspen leaf spot
poplar leaf spot
comandra rust
spruce rust broom
marsonnina blight
shoestring root rot

Insects

SAGUACHE COUNTY

Conophthorus cone beetles
western spruce budworm
fir engraver
a finger gall mite
buck moth
purple maple mite

SAN JUAN COUNTY

SAN MIGUEL COUNTY

fir engraver
fir bark beetle

SEDGWICK COUNTY

a pine sawfly
carpenterworm
eastern tent caterpillar
elm leaf beetle*
fall webworm
lesser European elm bark beetle
poplar leaf rollers
(miscellaneous)
lilac/ash borer
Zimmerman pine moth

SUMMIT COUNTY

mountain pine beetle*
Ips spp.*
Pondora moth

TELLER COUNTY

white pine weevil
twig beetles
mountain pine beetle
pine budworm*
western spruce budworm
western tent caterpillar
eriophyiid mites
spider mites

Diseases

Douglas-fir dwarf mistletoe*
lodgepole pine dwarf mistletoe
southwestern dwarf mistletoe
brown crumbly rot
Indian paint fungus
juniper broom rust
juniper gall rust
annosus root rot

Douglas-fir dwarf mistletoe

Douglas-fir dwarf mistletoe
juniper true mistletoe
pinyon pine dwarf mistletoe
southwestern dwarf mistletoe

Dutch elm disease

lodgepole pine dwarf mistletoe*

Douglas-fir dwarf mistletoe
shoestring root rot
southwestern dwarf mistletoe

Insects

WASHINGTON COUNTY

a walking stick
lesser European elm bark beetle
pine tip moth
a pine sawfly complex
euura borer

WELD COUNTY

aphids
ash bark beetle
a pine sawfly
cooley spruce gall aphid
cottonwood blotch miners*
cottony maple scale
elm leaf beetle*
pitch nodule moths
lesser European elm bark beetle
mountain pine beetle
pine sawfly
pine tip moths
ponderosa needle miner
western tiger swallowtail
hackberry leaf miner
poplar leaf beetle
giant willow aphid
lilac/ash borer

YUMA COUNTY

elm leaf beetle
fall webworm*
lesser European elm bark beetle
pine tip moths
hackberry bark beetle
poplar twig gall aphid
dog day cicad
carpenterworm
western tent caterpillar
big poplar sphinx moth
fomes decay of black locust
locust borer
locust leafminer
buck moth
carpenterworm
eriphyiid mites
fruit tree leafroller
a walking stick
euura borer
a hackberry engraver
a willow clearwing borer
seed beetle

Diseases

Dutch elm disease

drought stress
Dutch elm disease*
peach cytospora
tubercularia canker
slime flux
fireblight
venturia blight of cottonwood
bacterial blackspot
cytospora canker

Dutch elm disease
powdery mildew
thyronectria canker

A P P E N D I X I I

Insect and Disease Occurrence by Host

(* indicates 1979 observation)

alder

(*Alnus* spp.)

alder flea beetle

leaf beetle

Phyllonorycter sp.

spittlebug

an alder sawfly

yellow and black halisidota

apple

(*Malus* spp.)

aphids *

cigar casebearer

fruit-tree leaf roller *

shot-hole borer *

fireblight *

powdery mildew

ash, European

(*Fraxinus excelsior* L.)

lilac borer

banded ash borer

oystershell scale

ash plant bug

fall webworm

forest tent caterpillar

two-spotted spider mite

wooly aphid

ash, green (*Fraxinus pennsylvanica* Marsh)
ash bark beetle *
ash flower gall mite
lilac borer *
banded ash borer
carpenterworm
small banded ash borer
oystershell scale
redheaded ash borer
tiger swallowtail *
cytospora canker
ash plant bug *
western tiger swallowtail
cottony maple scale

aspen, quaking (*Populus tremuloides* Michx.)
an aspen *Agrilus* sp. or spp.
a tachinid fly
aspen twig gall fly
forest tent caterpillar *
an aspen bark beetle
oystershell scale
an aspen leaf spot
oyster mushroom
artist conk
buck moth
western tent caterpillar

* indicates 1979 observation.

aspen, quaking poplar leaf spot *

continued:

Cryptosphaeria canker

poplar borer *

poplar leaf miners (miscellaneous)

ugly-nest caterpillar

western tent caterpillar *

aspen ink spot *

aspen ambrosia beetle

Ceratocystis canker *

Cenangium canker *

Cytospora canker *

Cryptochaete sp. *

false-tinder fungus *

Pollacia blight *

Ganoderma decay *

eriophyid mites *

mite galls *

Agriilus borer *

poplar tent-maker *

Hypoxyton canker

Ambrosia beetle

birch,
water

(*Betula occidentalis* Hook.)

alder spittlebug *

birch nipple gall mite *

blotch leaf miner *

* indicates 1979 observation.

birch, water continued:	birch sawfly *
	Nectria dieback *
	alder sawfly *
	bronze birch borer *
	Melanconium canker
	Nectria canker
boxelder	(<i>Acer negundo</i> L.)
	A tortricid leaf roller
	boxelder bug
	boxelder leaf roller *
	green fruitworm *
	linden looper *
	elm spanworm
	cottony maple scale
buckeye, Ohio	(<i>Aesculus glabra</i> Willd.)
	cottony maple scale
caragana	(<i>Caragana arborescens</i> Lem)
	ash-grey blister beetle
catalpa	(<i>Catalpa</i> spp.)
	catalpa leaf spot
cherry	(<i>Prunus</i> spp.)
	fireblight
	bacterial black spot
	black knot of cherry
	shot-hole borer

* indicates 1979 observation.

cherry, choke (*Prunus virginiana* L.)

ugly-nest caterpillar

western tent caterpillar

buck moth

cottonwood (*Populus* spp.)

buffalo tree hopper

cottonwood blotch miner *

cottonwood leaf beetle *

clearwing moth *

cottonwood twig borer *

Eriophyiid mites

spiny elm caterpillar

stink bug

slime flux

oyster mushroom

a narrow-leaf cottonwood psyllid

short-horned grasshoppers

fall webworm *

midge galls *

oystershell scale

horntail *

poplar leaf rollers * (miscellaneous)

poplar leaf beetle *

western tent caterpillar

Weidemeyer's admiral butterfly

* indicates 1979 observation.

cottonwood	cottonwood leaf spot
continued:	poplar tent-maker
	cytospora canker *
	stigma blight
	slime flux (wetwood) *
	Fomes rot *
	Ganoderma decay
	<i>Euura</i> borer
	ink spot
	Buffalo tree hopper
	Petiole gall aphid *
	venturia blight *
	poplar sphinx moth *
	Dog day cicada
	buck moth
	poplar gall borer
	poplar bud gall mite
Douglas-fir	(<i>Pseudotsuga menziesii</i> var. <i>glauca</i> (Mirb.) Franco)
	Douglas-fir bark beetle *
	Douglas-fir pole beetle *
	Douglas-fir tussock moth
	flocculent fir aphid
	strawberry root weevil
	western spruce budworm *
	bacterial gall *

* indicates 1979 observation.

Douglas-fir	pine tiger moth
continued:	Douglas-fir dwarf mistletoe *
	Armillaria root rot *
	fir engraver *
	brown crumbly rot *
	spider mites *
	weevil
	twig beetle
	pouch fungus
elm	(<i>Ulmus</i> spp.)
	elm leaf beetle *
	European elm scale *
	lesser European elm bark beetle *
	squirrels
	oystershell scale
	pole borer
	spiny elm caterpillar
	elm borer
	woolly elm aphid
	European fruit lecanium
	cottony maple scale
	Dutch elm disease *
	red elm bark weevil *
	slime flux (wetwood) *
	flatheaded apple tree borer *
	aphids *

* indicates 1979 observation.

elm
continued:

- green fruitworm *
- slime mold *
- unicorn caterpillar
- polyphemus moth
- Cecropia moth
- carpenter worm *
- Tubercularia canker *
- Dog day cicada *
- fall canker worm *
- Putnam scale
- Polyporus hispidus*
- herbicide damage
- short-horned grasshopper
- a canker worm

fir, corkbark (*Abies lasiocarpa* var. *arizonica* (Merriam) Lemm.)

- western spruce budworm

fir, subalpine (*Abies lasiocarpa* (Hook) Nutt.)

- western balsam bark beetle *
- western spruce budworm
- fir witches'-broom *
- Armillaria root rot *
- fir engraver *
- fir bark beetle *

fir, white (*Abies concolor* (Gord. & Glend.) Hoopes)

- fir engraver *

* indicates 1979 observation.

fir, white continued:	western spruce budworm * white fir needle miner * fir witches'-broom * Armillaria root rot * Indian paint fungus * nematodes * white fir needle cast pine tiger moth <i>Fomes annosus</i> *
hackberry	<i>(Celtis occidentalis L.)</i> hackberry engraver * hackberry butterfly hackberry nipplegall-maker * cottony maple scale hackberry bark beetle * eriophyid mites * powdery mildew * hackberry petiolegall psyllid Camarosporium canker fall canker worm * fruit tree leaf roller leaf miner *
hawthorn	<i>(Crataegus sp.)</i> Bethel rust * fireblight *

* indicates 1979 observation.

honeylocust (*Gleditsia triacanthos* L.)
 a flatheaded wood borer
 honeylocust pod gall midge
 cottony maple scale
 thyronectria canker *
 seed beetle *
 Cytospora canker
 horse chestnut (*Aesculus* sp.)
 cottony maple scale *
 juniper (*Juniperus* spp.)
 a cicada
 a flatheaded wood borer
 a juniper leaf miner *
 juniper webworm
 juniper spittlebug
 juniper true mistletoe *
 juniper broom rust *
 twig borer *
 spider mite *
 Fomes rot *
 spittlebug *
 juniper gall rust *
 short-horned grasshoppers
 lilac, common (*Syringa vulgaris* L.)
 lilac borer *

* indicates 1979 observation.

lilac, common	oystershell scale
continued:	lilac leaf miner
	short-horned grasshopper
locust, black	(<i>Robinia pseudoacacia</i> L.)
	locust leaf miner
	locust borers
	Fomes decay
maple, Rocky Mountain	(<i>Acer glabrum</i> Torr.)
	purple erineum maple mite *
maple, silver	(<i>Acer saccharinum</i>)
	American dagger moth *
	cottony maple scale *
	oystershell scale
	pole borer
	pigeon tremex (horntail) *
	Phyllosticta blight
mountain mahogany	(<i>Cercocarpus</i> spp.)
	western tent caterpillar
	mountain mahogany bark beetle *
oak, gambel	(<i>Quercus gambelii</i> Nutt.)
	forest tent caterpillar
	Sonoran tent caterpillar *
	oak lacebug *
	oak blister fungus
	a cicada
	oak leaf roller

* indicates 1979 observation.

oak, gambel	oak kermes scale
continued:	a tortricid leaf roller complex
	linden looper
	ugly-nest caterpillar
peach	(<i>Prunus persica</i>)
	Cytospora canker
pear	(<i>Pyrus</i> spp.)
	fireblight *
pea tree, Siberian	(<i>Caragana arborescens</i>)
	ash-grey blister beetle
pine, Austrian	(<i>Pinus nigra</i> Arnold)
	pine needle scale
	pine tip moths
	Zimmerman pine moth
	Southwestern pine tip moth *
	short-horned grasshopper
	pine sawfly complex
pine, bristlecone	(<i>Pinus aristata</i> Engelm.)
	limber pine dwarf mistletoe
	twig beetles
pine, limber	(<i>Pinus flexilis</i> James)
	limber pine dwarf mistletoe
	lodgepole pine dwarf mistletoe
	southwestern dwarf mistletoe
	pine horntail *
	spider mites *

* indicates 1979 observation.

pine, mugo	(<i>Pinus mugo</i> Turra)
	Southwestern pine tip moth *
pine, lodge- pole	(<i>Pinus contorta</i> Dougl.)
	<i>Ips</i> spp. *
	lodgepole pine terminal weevil
	mountain pine beetle *
	Pandora moth *
	pine tiger moth
	pine shoot moth
	western pine shoot borer
	comandra blister rust *
	dwarf mistletoe rust
	limber pine dwarf mistletoe
	lodgepole pine dwarf mistletoe *
	southwestern dwarf mistletoe
	western gall rust *
	Armillaria root rot *
	twig beetles *
	porcupine damage *
	a lodgepole needle cast
pine, ponderosa	(<i>Pinus ponderosa</i> var. <i>scopulorum</i> Engelm.)
	a cone weevil
	a pine horntail *
	a pine moth
	a pine sawfly (complex) *

* indicates 1979 observation.

pine,
ponderosa
continued:

bull pine sawfly
flatheaded wood borer *
giant conifer aphids
Hylurgops spp.
Ips spp. *
mountain pine beetle *
Black Hills Pandora moth *
pine budworm *
pine butterfly *
pine needle scale
pine tiger moth *
pine tip moths *
pine bud gall midge *
cone worm *
broadnosed weevil *
Leptoglossus leaf-footed bug
Dioryctria cone moths
Conophthorus cone beetles
Rhizina root rot
pitch nodule moth
a pine flatbug
pine aphids *
spider mites *
pine cone moth *
grey false pine looper *

* indicates 1979 observation.

pine,
ponderosa
continued:

yellow false pine looper
pine tussock moth *
short-horned grasshoppers
solitary web-spinning sawfly
pine webworm (or near relative)
pitch nodule moths *
ponderosa needle miner *
red turpentine beetle *
roundheaded pine beetle *
twig beetle *
western pine beetle *
limber pine dwarf mistletoe
limb rust
lodgepole pine dwarf mistletoe
southwestern dwarf mistletoe *
western gall rust
Armillaria root rot *
brown crumbly rot *
southwestern pine tip moth *
clerid beetle *
Zimmerman moth *
pine long-horned borers
pine metallic wood borers
chafers
elfin butterfly
pouch fungus *

* indicates 1979 observation.

pine, Scots	<i>(Pinus sylvestris L.)</i>
	pine needle scale
	pine tip moths
	nematodes *
	pine moth *
	pine aphids *
	Zimmerman moth *
	short-horned grasshoppers
	Southwestern pine tip moth
	yellow-bellied sapsuckers
pinon (or pinyon)	<i>(Pinus edulis Engelm.)</i>
	<i>Ips</i> spp. *
	pine needle scale
	a pine moth
	mountain pine beetle *
	pinon pitch borer
	pine tiger moth
	<i>Conophthorus</i> cone beetles
	a cicada
	pinon needle miner
	pinon needle scale
	pitch nodule moths
	twig beetle *
	black stain root disease
	pinon pine dwarf mistletoe
	shoestring root rot

* indicates 1979 observation.

pinon	blue stain *
(or pinyon)	Zimmerman moth *
	spider mites *
	a pinyon needle cast
plum	(<i>Prunus</i> spp.)
	pear sawfly
	woolly aphids *
	Cytospora canker *
	an alder sawfly
	fireblight
	aspen leaf miner
	choke cherry aphid
	a finger gall mite *
	powdery mildew *
	shot hole *
	western tent caterpillar *
	ugly-nest caterpillar
	brown apricot scale *
	choke cherry leaf aphid *
	fruit tree leaf roller *
	tiger swallowtail
	plum pocket
	poplar leaf-folding sawfly
poplar	(<i>Populus</i> spp. including <i>alba</i>)
	a white poplar clearwing borer

* indicates 1979 observation.

redbud	(<i>Cercis</i> spp.)
	drought stress
Russian olive	(<i>Elaeagnus angustifolia</i> L.)
	gummosis *
	tubercularia canker *
sagebrush	(<i>Artemisia</i> sp.)
	insect galls
spruce, blue	(<i>Picea pungens</i> Engelm.)
	Douglas-fir tussock moth *
	pine needle scale *
	western spruce budworm
	white pine weevil *
	spruce witches' broom *
	spider mites *
	cone worm *
	stink bugs *
	web-spinning sawfly *
	needle cast
	cooley spruce gall adelgid *
	lace bug *
	short-horned grasshoppers
	spruce needle miner
spruce, Engelmann	(<i>Picea engelmanni</i> Parry)
	a spruce tussock moth
	Douglas-fir tussock moth

* indicates 1979 observation.

spruce,	pitch mass borer *
Engelmann	
continued:	spruce bark beetle
	spider mites
	western spruce budworm
	white pine weevil *
	Armillaria root rot *
	pocket rot *
	Cytospora canker *
	brown crumbly rot *
	pitch midge *
	cooley spruce gall adelgid *
	shoestring root rot
	spruce witches'-broom *
sycamore	(<i>Plantanus occidentalis</i> L.)
	anthracnose
	drought stress
Tree of Heaven	(<i>Ailanthus altissima</i>)
	Cytospora canker
willow	(<i>Salix</i> spp.)
	a gray tree hopper
	buffalo tree hopper
	cottonwood leaf beetle
	a willow clearwing borer
	eastern tent caterpillar
	oystershell scale
	Poplar-willow borer

* indicates 1979 observation.

willow
continued:

- woolly aphid
- willow pod gall aphid
- willow stem gall sawfly
- cecropia moth
- Io moth
- redhumped caterpillar
- Weidemeyer's admiral butterfly
- willow leaf beetle
- yellow buck moth
- forest tent caterpillar
- slime flux (wetwood)
- weevil
- a mining sap feeder
- clearwing moth borer
- saperda borer
- tiger moth
- carpenter worm
- Cytospora canker
- bean gall sawfly
- yellow and black Halisidota
- a katydid
- viceroi butterfly
- Glover's silk moth
- polyphemus moth**
- giant willow aphid

* indicates 1979 observation.

willow
continued:

poplar gall borer

pine cone gall-maker

a willow rosette gall midge

Euura gall sawfly

APPENDIX III

Publications, Reprints and Audio-Visuals Available

Insect and Disease Division Colorado State Forest Service

Reprints and Original Publications:

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- Helburg, L. B., M. E. Schomaker and R. A. Morrow, 1973. A new trunk injection technique for systemic chemicals. Plant Disease Reporter 57: 513-14.
- Krieg, Stephen J., Mark E. Schnobrich, and Michael E. Schomaker, 1978. Colorado's 1978 federal Dutch elm disease control demonstration project. Unpublished report.
- Krieg, Stephen J., Michael E. Schomaker and John G. Laut, 1979. Colorado's 1979 federal Dutch elm disease control demonstration project. Unpublished report.
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- Laut, John G., 1972. Disease surveys in Western North American forests, in Proceedings of the 20th Western International Forest Disease Work Conference pp. 20-25.
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- Laut, John G. 1975. Pest Management in Residential Forests. In 2nd FAO/IUFRO World Consultation on Forest Pest Control. New Delhi, India, April 1975.
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- Laut, John G., L. B. Helburg and R. A. Morrow, 1972. Dutch elm disease in Colorado -- 1971. Plant Disease Reporter 56: 912-913.
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- Laut, John G. and David A. Leatherman, 1977. Mountain Pine Beetle: The Silent Killer. Proceedings of 7th Annual Colorado Crop Protection Institute, Colorado State University. pp. 65-68.
- Laut, John G. and David A. Leatherman, 1977. Mountain Pine Beetle in the Front Range of Colorado, in Proceedings of Western Forestry Conservation Association, Portland, Oregon, December 1976.
- Laut, John G., N. Oshima and L. E. Dickens. 1969. The recurrence of Dutch elm disease in Colorado. Plant Disease Reporter 53: 253.
- Laut, John G. and M. E. Schomaker, 1974. Dutch Elm Disease: A bibliography. pp. 95, 1404 entries. Colorado State Forest Service, Colorado State University, Fort Collins.
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- Laut, John G., Michael E. Schomaker, Theresa M. Stieger and JoAnn Metzler, 1979. Dutch Elm Disease, a bibliography. Revised. 2398 entries. Colorado State Forest Service.
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- McCambridge, Wm. F., F. G. Hawksworth, Carleton B. Edminster and John G. Laut, 1980. Mountain Pine Beetle Impact on a Ponderosa Pine Forest (in preparation as a Station Technical Report, U. S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado).

McCambridge, Wm. F., John G. Laut and Ronald A. Gosnell, 1975. Fumigate Firewood Infested with Mountain Pine Beetle. USDA-Forest Service Research Note RM-289.

Morrow, Ronald A., 1972. *Dendroctonus ponderosae*: the Mountain pine beetle. Literature review and bibliography. Unpublished report, Colorado State Forest Service (out of print but may be borrowed).

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Schomaker, Michael E., 1977. Dutch Elm Disease: A bibliography. Addendum. April 1977. Colorado State Forest Service.

Stevens, Robert E., Clifford A. Myers, Wm. F. McCambridge, George L. Downing, and John G. Laut, 1975. Mountain Pine Beetle in Front Range Ponderosa Pine, USDA Gen. Tech. Rpt. RM-7.

Sutton, B. C. and John G. Laut, 1970. *Graphium penicillioides* on American elm in Manitoba and Saskatchewan. Canadian Forestry Service, Bi-Monthly Research Notes, 26 (3): 25-26.

Audio-Visuals:

Dutch Elm Disease. A slide-tape program, with script.

Forest Insects and Diseases of Colorado. A slide-tape training program.

Silent Killer. 16mm movie on mountain pine beetle and its control.

14 minutes.

Dutch Elm Disease: Catalyst to Community Forestry. 16mm movie. 22 minutes.

Information Sheets:

Dutch Elm Disease -- fact sheet.

Dutch Elm Disease in Colorado -- pamphlet.

Dutch Elm Disease -- poster series (5, 1 in Spanish)

Mountain Pine Beetle (MPB) Control -- cartoon booklet

Forest Disease and Insect Records Computerized

John G. Laut

Reports and records of diseases, causal organisms and insects, gathered through surveillance and detection surveys by the Colorado State Forest Service, have been computerized to facilitate their use. FAMULUS, a program developed to handle literature compilations, was modified to meet our needs.

Information on each collection or report is organized by fields and can be searched, compiled, compared or otherwise manipulated in a variety of ways. The fields, and information presently contained in each are:

1. "District": State, county organization (e.g., Colorado State Forest Service, U. S. Forest Service), district name (e.g., Grand Junction (CSFS) or Pike National Forest, San Carlos District), specific location (e.g., legal description or grid, etc. will be added to this field).
2. Date: Date collected, laboratory sequence number.
3. Host: By scientific and/or common name.
4. "Name": The common name of the disease or insect (e.g., Dutch elm disease, dwarf mistletoe).
5. Species: Scientific name of organism involved.
6. Description: Basic stand information (e.g., urban forest, plantation, etc.), average DBH, size class of trees, number of trees involved.
7. Symptoms: Part of tree involved and descriptors of the problem.
8. Damage: More detailed descriptors.
9. Enclosures: What kind of sample or specimen was received with report.
10. History: Stand information -- previous disturbance by fire, logging, pests, weather, man, etc.

The system presently contains CSFS records for 1978 and 1979. Older records will be added as time is available. Our plans also include adding herbarium records from the Rocky Mountain Forest and Range Experiment Station.

Any organization that takes this type of data and requires periodic compilations are invited to participate or develop their own system. The basic program is extremely flexible and, since no coding of field information is required, it is easy to operate and maintain.

Bibliography of Dutch Elm Disease

John G. Laut

The bibliography of Dutch elm disease, first published in 1974, has been continuously updated since that time. It now has been computerized utilizing the FAMULUS system¹ for information retrieval. It presently contains over 2500 citations, many of which are accompanied by abstracts. New citations are added weekly.

Users can now obtain searches, and print-outs, for any DED-related subject. The information is organized into several fields to facilitate retrieval. Searches of one or more of the fields can be made for broad or specific subjects. Persons requesting information should decide as precisely as possible what information is desired.

The 1979 Addendum to the Bibliography is now available. It contains 126 "new" references and includes abstracts of those references.

Holders of the January 1979 edition will receive the addendum upon request. The entire bibliography (2524 references) can be purchased for \$6.50.

Requests for searches or copies can be made to John G. Laut, Colorado State Forest Service, Colorado State University, Fort Collins, Colorado 80523; telephone (303) 491-6303.

¹ USDA-Forest Service, 1969. FAMULUS: A personal documentation system -- A users manual. USDA-Forest Service, Pacific SW Forest and Range Experiment Station, Misc. Publ. 33 pp.

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